

IN SEARCH OF THE MISSING LINK:
RELATING DESTRUCTION TO OUTCOME IN AIRPOWER APPLICATION

BY
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Abstract

Targeting has been the central problem of air strategy since the dawn of modern airpower. One of the most difficult challenges for airpower strategists has been how to relate the physical or functional destruction of targets to attainment of political and military objectives. This paper examines the fundamental problem of relating destruction inflicted on a target system to the desired outcome and presents the Destruction-Outcome Linkage Model to serve as a framework for analysis of past air campaigns. This model links destruction of the “pieces” of a target system to the desired outcome.

Using the Destruction-Outcome Linkage Model as a framework for analysis, this paper traces how airpower strategists have conceptualized the linkage, applied it to past air campaigns and the extent to which their conception was accurate based on the results achieved. The goal is to determine how effectively air strategists have linked destruction to outcome and draw conclusions about the Air Force’s ability to make such linkages in the future. To sufficiently narrow the scope of the paper, a single target system will be used to illustrate this analysis -- the transportation system.

The transportation system was chosen because it often appears as a lucrative and vulnerable target system to the airpower strategist. Its appeal as a lucrative target is related to the role of transportation in supporting both the adversary’s economic and military power. The vulnerability of an adversary’s transportation is based on the fact that transportation networks typically consist of many fixed or easily locatable components such as bridges, marshaling yards, and means of conveyance. Because of these factors, transportation systems have been singled out for attack throughout the history of airpower. Thus, there is ample historical evidence to draw upon.

Four air campaigns are analyzed: The Transportation Plan of World War II, Strangle in the Korean War, Rolling Thunder in the Vietnam War and Desert Storm. These air campaigns were selected for three reasons: 1) They span a period of 50 years, permitting trends in airpower development and the evolution of targeting theory to be more easily discerned, 2) They cover a variety of conditions, circumstances and factors under which airpower was applied, and 3) They all involve targeting efforts against the adversary’s transportation system.

The conclusion of this paper is that while our ability to inflict destruction with conventional airpower has increased by several orders of magnitude over the past 50 years, the thinking behind how the destruction is linked to the desired outcome has increased only marginally. The foundation of airpower theory, and by implication, the basis for targeting, still relies very heavily on the Douhetan notion of breaking the enemy's will with attacks on the "vital centers." The concept of what constitutes a "vital center" has changed over the years, but the idea that destroying a small set of targets in the enemy's homeland is the key to coercive success seems to dominate airpower targeting philosophy. Locating the targets that will have the greatest coercive effect on the adversary is exactly what airpower strategists should be doing. However, it is extraordinarily difficult to find the "right things" within the enemy's homeland and the optimum air campaign is not likely to result from application of flawed, simplistic airpower theories. Developing the airpower strategies of the future requires a clear understanding of the linkage between destruction and outcome.

About the Author

Major (Lieutenant Colonel-Select) Kevin E. Williams (B.S. Electrical Engineering, Kansas State University, M.S. Electrical and Computer Engineering, University of Texas at Austin) was commissioned through the Air Force ROTC program. He began active duty in 1980 at Williams AFB, AZ, attending Undergraduate Pilot Training. Upon graduation from pilot training in 1981, he was assigned to RAF Lakenheath, United Kingdom, to fly the F-111F and upgraded to flight lead, instructor pilot, and standardization and evaluation flight examiner. In 1985, CINCUSAFE selected him for the Senior Commander's Sponsored Education Program and he attended the University of Texas at Austin. After graduation in 1986, he was assigned to Wright-Patterson AFB, OH. While there he was involved with the B-1B, B-2, and F-15E acquisition programs and was part of the team that won the 1987 MacKay Trophy. He also was selected to participate in the First Flight Readiness Review for the B-2A. In 1989, he was assigned to Cannon AFB, NM, to fly the F-111D. While there, the 12th Air Force commander selected him as the 1990 12th Air Force Flight Commander of the Year. Major Williams is a Distinguished Graduate of AFROTC, Squadron Officer School, and Air Command and Staff College and a graduate of the School of Advanced Airpower Studies at Maxwell AFB, AL.

Chapter One

Introduction

“...it is the principal task of the commander to devote his entire mental powers and energy to gaining for his own army the greatest possible advantages in the decisive action and to make his victory as great as possible...his analysis considers in...what way he can find the enemy vulnerable...whether he should besiege a fortress, occupy a province, cut off the enemy's supplies, attack by surprise an isolated portion of the enemy's army, alienate one of the enemy's allies, win over an ally for himself, but most importantly, whether an occasion and a good chance arises to defeat the enemy's main force.”¹

-Hans Delbrück
History of the Art of War

Targeting has been the central problem of air strategy since the dawn of modern airpower.² One of the most difficult targeting challenges for airpower strategists has been how to relate the destruction of targets to attainment of the military and political objectives. This paper examines the fundamental problem of relating destruction inflicted on a target system to the desired outcome. It analyzes how well airpower strategists have conceptualized this linkage, applied it to past air campaigns, and the extent to which their conception of the linkage matched results achieved in combat. Using this analysis, we will be able to see the evolution of targeting theory within the Air Force. We want to find out if we are improving our ability to link destruction to outcome over time. The conclusion of this paper is that our ability to make the destruction-outcome linkage has improved only marginally, if at all.

Recent literature and studies related to targeting theory have shown why or how individual target systems should or should not be attacked, proposed organizational changes to improve the effectiveness of airpower, or advocated various ideas about the efficacy of conventional airpower such as its ability to produce “paralysis” through strategic attack.³ What is lacking in the debate about targeting is how the destruction of the enemy’s target arrays contributes to or produces the desired outcome. There is little

explanation of the linkage between destruction of targets and the outcome except to assert that by destroying the “right” things, we can impose our will on the enemy. There is a large piece of analysis missing between destroying parts of target systems and achieving the desired outcome. In other words, there is a missing link.

Relating destruction of targets to the desired outcome is an extremely complex and demanding problem. The current official framework for relating destruction to outcome is a six-phase process “that focuses intelligence efforts to support operational planning and facilitates force employment to achieve the commander’s objectives.”⁴ Underpinning this framework is official doctrine. Airpower doctrine, as defined in Air Force Manual (AFM) 1-1, is “what we hold true about aerospace power and the best way to do the job in the Air Force.”⁵ In theory, by using intelligence analysis and flexibly applying airpower doctrine to the construction of an air campaign designed to meet political and military objectives, we should be able to clearly and convincingly explain how the planned attack of a target system will contribute to the desired outcome.

However, the history of air campaigns reveals an imperfect understanding of the linkage between destruction and outcome. The problem has not been failure in *trying* to make the linkage. The shortfall has existed in understanding *how* the capability to inflict damage contributes to the desired outcome. As we will see, the airpower theory developed between the two world wars formed the root of the problem. This theory depended on a number of assumptions later shown to be incorrect, particularly the belief in the fragility of the adversary’s national will. Nonetheless, the foundation of airpower theory, and by implication, the basis for targeting, still relies very heavily on the notion of breaking the enemy’s national will. Unfortunately, this belief has contributed to an oversimplification of how destruction is linked to outcome.⁶

The goal of this paper is not to determine how to attack a specific target system. However, for illustrative purposes, we will use a single target system to trace how airpower strategists have thought about the linkage of destruction to outcome. While we

could use any one of a number of different target systems, transportation was chosen because it often appears as a lucrative and vulnerable target system. It is appealing due to its role in supporting the adversary's economic and military power. The vulnerability stems from the fact that it typically consists of fixed or easily locatable components such as bridges, marshaling yards, and means of conveyance. The U.S. has conducted major air campaigns against transportation systems in every major conflict beginning with World War II which has produced considerable historical evidence to draw upon.

Overview

Chapter Two is the introduction and explanation of the Destruction-Outcome Linkage Model. The model is an abstraction of one possible way of thinking about the linkage between destruction and outcome. It will serve as a baseline for comparison with how airmen attempted to link destruction to outcome as they planned and conducted past air campaigns against transportation. Then, we will examine four air campaigns in Chapters Three through Six.⁷ Chapter Three deals with the Transportation Plan of World War II. This is followed by the Strangle campaign of the Korean War in Chapter Four. Next we look at Rolling Thunder in Vietnam in Chapter Five. Chapter Six addresses the most recent application of airpower in a major conflict -- the Persian Gulf War.

The methodology of the paper is straightforward. Each of the four chapters on air campaigns will generally follow the same template. First, we establish the state of airpower by reviewing the development of doctrine, technology, and capabilities in the period leading up to the air campaign.⁸ Second, we discuss the planning for the air campaign to see how the planners viewed the linkage between destruction and outcome. Third, we examine the execution of the campaign to find out the actual destruction and outcome achieved. Finally, we tie it all together by analyzing the airpower development, planning, and results achieved in terms of the Destruction-Outcome Linkage Model.

Notes

¹ Hans Delbrück, History of the Art of War (Westport, CT: Greenwood Press, 1985) Vol. IV, 294.

² As General Hoyt S. Vandenberg put it, “The problems of selecting appropriate target systems and specific targets within these systems is of over-riding importance. It is a matter for continuing study, refinement, and re-evaluation.” Testimony prepared for General Hoyt S. Vandenberg, Chief of Staff of the Air Force before the House Armed Services Committee, July 1949, AFHRA File No. 168.7017-21.

³ Some samples include: Major Gerald R. Hust, “Taking Down Telecommunications,” School of Advanced Airpower Studies Thesis, Maxwell AFB, AL, 1993. This paper describes how to attack a telecommunications system; Major Scott E. Wuesthoff, “The Utility of Targeting the Petroleum-Based Sector of a Nation’s Economic Infrastructure,” School of Advanced Airpower Studies Thesis, Maxwell AFB, AL, 1993. The author argues that, for the foreseeable future, oil is a lucrative target worthy of air attack; Major Thomas E. Griffith, Jr., “Strategic Attack of National Electric Systems,” School of Advanced Airpower Studies Thesis, Maxwell AFB, AL, 1993. Major Griffith believes that the enemy’s electrical power system should not be attacked, except when the goal is to “stop war production over the long term.”; Major Jason B. Barlow, “Strategic Paralysis: An Airpower Theory for the Present,” School of Advanced Airpower Studies Thesis, Maxwell AFB, AL, 1992. Major Barlow’s thesis is representative of the school of thought that advocates if the right targets are destroyed in the enemy’s homeland, then they can be “strategically paralyzed.”; Major J. Taylor Sink, “Rethinking the Air Operations Center: Air Force Command and Control in Conventional War,” School of Advanced Airpower Studies Thesis, Maxwell AFB, AL, 1993. Here Major Sink presents ideas about how to improve the organizational structure for real-time decision-making about targeting; RAND has been tasked to produce a series of analyses, under the Project Air Force contract with Hq USAF, specifically related to air campaign planning, strategic paralysis, and modeling various target systems such as electrical power.

⁴ Department of the Air Force, AFR 200-16, “Intelligence: Air Force Targeting,” (Washington, DC: US Government Printing Office, 28 March 1990), 1. The six steps are: 1) Objectives and Guidance, 2) Target Development, 3) Weaponing Assessment, 4) Force Application Planning, 5) Execution Planning, and 6) Combat Assessment.

⁵ Department of the Air Force, AFM 1-1, “Basic Aerospace Doctrine of the United States Air Force,” (Washington, DC: US Government Printing Office, March 1992), Vol. I, vii.

⁶ It has also caused airmen, from World War II to Desert Storm, to overstate the capability of airpower to achieve the desired outcome. For example, in planning Instant Thunder, airmen advocated that the air campaign “will bring about the progressive collapse of the entire Iraqi war machine.” They predicted it would be done in six days with the “neutralization” of less than 100 targets.

⁷ The campaigns were chosen because they offer a chronology and variety of modern airpower application. They cover a span of almost 50 years and involve limited and unlimited wars. They also involve significant efforts against the adversary’s transportation system. If any trends exist in the linking of destruction and outcome, they should be discernible in this sample of conflicts.

⁸ As Graham T. Allison points out, “If a nation performs an action of a certain type today, its organizational components must yesterday have been performing an action only marginally different from today’s action.” Graham T. Allison, Essence of Decision (Harvard: Harper Collins, 1971), 87. It is important to understand the state of airpower development in the period leading up to each air campaign. What airmen thought about airpower employment, capabilities, and technology played a role in influencing the destruction-outcome linkage.

Chapter Two

The Destruction - Outcome Linkage Model

“The application of the additional pressure necessary to cause a breakdown--a collapse--of this industrial machine by the destruction of some vital link or links in the chain that ties it together, constitutes one of the primary, basic objectives of an air force--in fact, it is the opinion of the school that this is the maximum contribution of which an air force is capable towards the attainment of the ultimate aim in war.”⁹

In this chapter, we introduce the Destruction-Outcome Linkage Model. The purpose of the model is to provide a framework for analyzing the planning, execution, and results of the air campaigns presented in this paper.

The Destruction-Outcome Linkage Model represents the linkage between destruction and outcome with four hierarchical levels of abstraction. Figure 1 depicts these levels for a notional transportation target system.¹⁰ Looking at each of the levels in turn:

First-order Effect: This is the actual destruction, physical or functional, of “something” within the target system.¹¹ The destruction of a rail bridge is a first-order effect.

Second-order Effect: This is the impact on target system capability. The destruction of a bridge causes some loss of capacity in the rail system. The adversary will react to this second-order effect by trying to keep the system functioning at a level that supports its military strategy.¹² The reaction could be to re-route traffic, build a temporary bridge, displace civilian traffic, use a different mode of traffic, or do nothing if the loss of the bridge was irrelevant to its military strategy. Before a second-order effect can be achieved, first-order effects must be inflicted at a rate sufficient to make an impact on capacity.

Third-order Effect: As more and more capacity of the transportation system is lost, and the adversary can no longer compensate for the damage, a third-order effect is

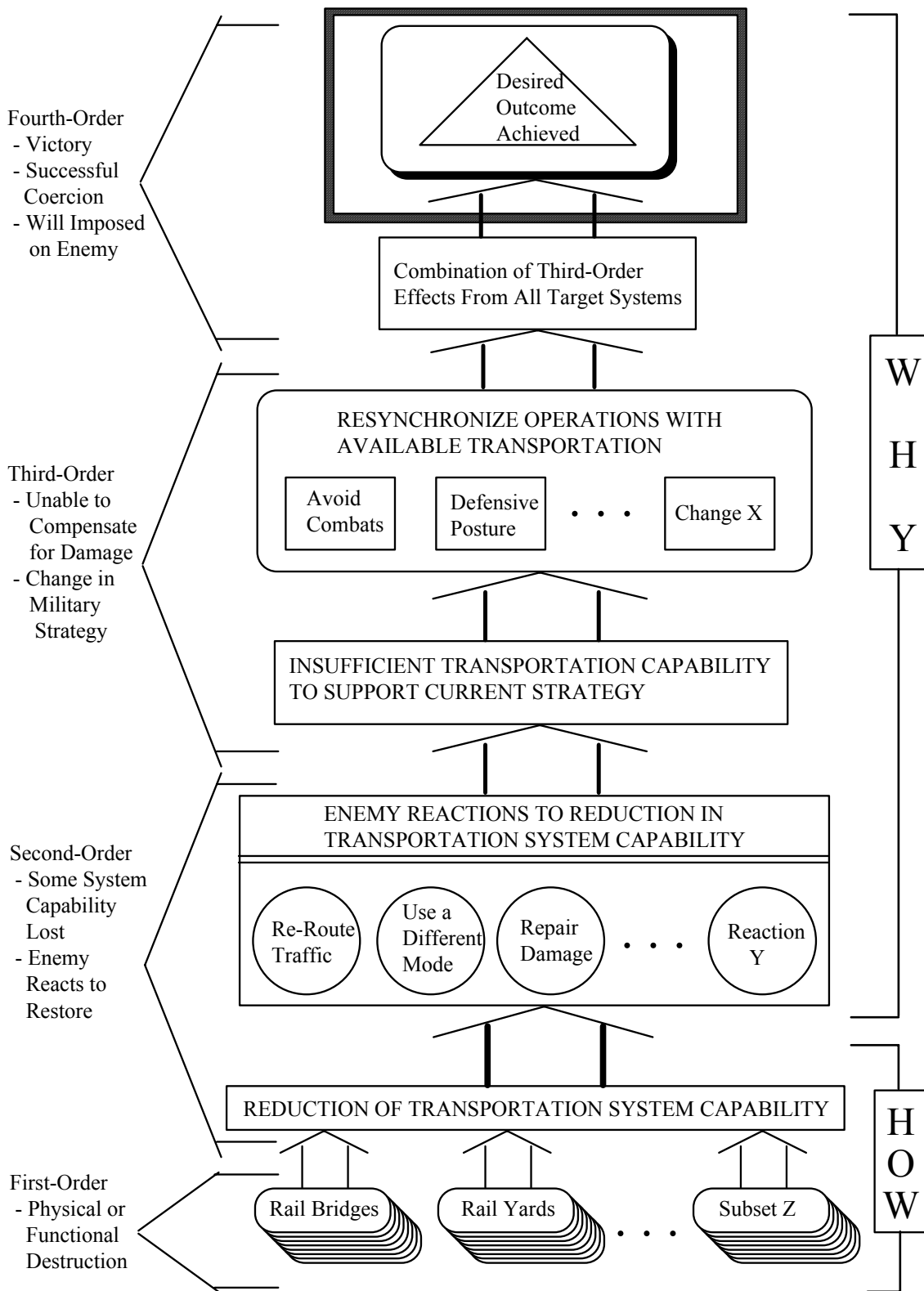


FIGURE 1. The Destruction-Outcome Linkage Model

achieved. At this level, the loss in the target system capability causes an impact on military strategy. The adjustment to military strategy could be in the form of re-synchronizing operations to the available transportation capability by such actions as conserving ammunition or avoiding combats. Reaching a third-order effect requires not only the ability to inflict first-order effects, but also the ability to overcome the enemy's reactions to second-order effects.

Fourth-order effect: The fourth-order effect is reached when, in Clausewitzian terms, we have imposed our will on the adversary. However, it is unlikely that the targeting of a single system will be sufficient to produce a fourth-order effect. The fourth-order effect will most likely be produced by achieving third-order effects in a unique and situational dependent set of target systems.¹³ (This is indicated by the shaded box around the fourth-order graphics.) One might equate a fourth-order effect to the desired impact on the perceptions of the adversary leadership.¹⁴ Imbedded within the leadership's perception is a subjective cost-benefit analysis. As it becomes increasingly difficult to overcome or adjust to the destruction, the leadership must decide whether to continue the conflict.¹⁵

Considering How and Why

Overlaid upon this model are two aspects that must be considered when analyzing any potential target system. They are *how* to effectively attack the system to produce physical destruction or functional degradation, and *why* does the attack of this system contribute to achieving the desired military and political objectives of the conflict (i.e., reaching fourth-order effects). A multitude of variables affects these two aspects, such as: doctrine, technology, force structure, political constraints, goals and objectives, institutional priorities and interservice rivalry, and the unique contextual elements of the situation. Because these factors affect the Destruction-Outcome Linkage Model, we will refer to them in each of the paper's air campaigns.

To answer the *how* question, one must not only understand the characteristics of the specific target system being attacked, but also the capabilities and limitations of airpower. Over time, the Air Force has steadily improved its efficiency in producing first-order effects, but has been less successful in translating efficiency into effectiveness.¹⁶ Maximizing efficiency means generating as much physical and functional first-order destruction as possible from the available force structure, technology, imperfect knowledge of the target system, and self-imposed political restraints. However, in the Destruction-Outcome Linkage Model, this efficiency is meaningless unless it contributes to achievement of the desired fourth-order effect.

Once we think we know how to target a system, we still need to decide whether we *should* target it. Although the target system may be vulnerable to attack, the resourceful adversary will deal with attacks on the system in many ways. For example, the adversary can respond to attacks on the transportation system with countermeasures such as substitution and diversion of materiel to other modes of transportation.¹⁷ If the enemy is unable to get the necessary materiel via the transportation system to support their current strategy and tactics, they may try to “re-synchronize” their strategy and tactics to the available transportation capability. By addressing the “why” question, we may find that attacking the target system or subsets within it may not be feasible or have as high a payoff as other target systems. Only through careful analysis of the linkage between destroying parts of the target system and the desired outcome can we get a good estimate of the answer to the “why” question.

Feedback Mechanisms

There must be feedback mechanisms to evaluate the effectiveness of first-order destruction, assess how the enemy is reacting to the first-order destruction, and determine the progress towards reaching the third-order effect. For example, battle damage assessment (BDA) should provide an evaluation of first-order destruction effectiveness. Strategic intelligence assets assess how the enemy is reacting and

determine the progress towards reaching the third-order effect. It becomes increasingly difficult to make assessments as we progress up the hierarchy of the Destruction-Outcome Linkage model. In other words, however difficult it may be to get accurate BDA on first-order effects, it is more difficult to assess how the enemy is reacting to the first-order destruction.¹⁸ Even more difficult is determining the progress towards reaching a third-order effect. Accurate intelligence information is vital to guiding decisions about targeting.

Summary

The Destruction-Outcome Linkage Model is a graphical representation of one possible way to relate destruction to desired outcome in a coherent manner.¹⁹ The model is useful in only a modest respect. It is in its ability to demonstrate that the linkage between destruction and outcome must be clearly and convincingly explained. It is nothing more nor less than an attempt to help airpower strategists think about the problem of selecting appropriate targets for attack by airpower. For the purpose of this paper, it serves as a framework to trace the evolution of targeting theory, its application, and results. With this in mind, we can now turn to the first of our four air campaigns -- the Transportation Plan of World War II.

Notes

⁹ Major Muir S. Fairchild, "National Economic Structure," Air Corps Tactical School Lecture, Maxwell AFB, AL, 6, AFHRA File No. 168.7001-31.

¹⁰ Since we are using the transportation system to present the paper's argument, it is depicted in the model. Theoretically, any target system can be modeled in this way.

¹¹ Functional destruction is the neutralization of a target's ability to perform its mission. In Desert Storm, for example, hardened aircraft shelters sometimes showed no external destruction except for the small opening created by the entrance of an LGB. The interior of the shelter, however, had been obliterated and the shelter was functionally destroyed even though the structure had not been completely destroyed. In future conflicts, the capability to produce functional damage may be dramatically increased using "non-lethal" weapons such as super-adhesives to close runways and anti-traction polymers to stop rail traffic. See Thomas E. Ricks, "Non-lethal Arms: New Class of Weapons Could Incapacitate Foe Yet Limit Casualties," The Wall Street Journal, 4 January 1993, 1.

¹² As Clausewitz put it, “In war, the will is directed at an animate object that *reacts*.” [emphasis in original] Carl von Clausewitz, On War, trans. Michael Howard and Peter Paret. (Princeton, NJ: Princeton University Press, 1984), 149.

¹³ The adversary’s target systems will be interdependent and self-compensating. Identifying the linkages between target systems and how breaking these linkages may contribute to defeating an adversary are part of a new way of doing center of gravity analysis using chaos theory. Applying chaos theory to center of gravity analysis is an emerging field of study in targeting theory. See Lieutenant Colonel Pat A. Pentland, “Center of Gravity Analysis and Chaos Theory,” Air War College Research Paper, Maxwell AFB, AL, 1993; Major Eileen Bjorkman, et.al., “Chaos Primer,” Air Command and Staff College Research Paper, Maxwell AFB, AL, 1993.

¹⁴ Colonel John Warden argues that “one does not conduct an attack against industry or infrastructure because of the effect it might or might not have on fielded forces,” but to affect the mind of the enemy leadership. In essence, he believes you target to produce what I have called a fourth-order effect. See Colonel John A. Warden III, “Employing Air Power in the Twenty-first Century,” The Future of Air Power in the Aftermath of the Gulf War, eds. Richard H. Schultz Jr., and Robert L. Pfaltzgraff Jr. (Maxwell AFB, AL: Air University Press, 1992), 67.

¹⁵ Predicting the point at which the adversary will or should surrender has been unsuccessful. According to Graham T. Allison, “Never in history have nations surrendered at exactly the point that costs start to exceed benefits. Surrender occurs sometime thereafter.” See Graham T. Allison, “The Cuban Missile Crisis: A Case Study of Crisis Decision-making,” American Defense Policy, eds. John F. Reichart, and Steven R. Sturm. Fifth ed. (Baltimore: Johns Hopkins University Press, 1982), 609.

¹⁶ As an example, according to its two principal directors - Col John E. Van Duyn and Col Robert L. Gleason - Corona Harvest was unable to accomplish its principal purpose: a meaningful evaluation of overall air power effectiveness in the Vietnam War. “The old standards for measuring air power's effectiveness - sortie rates, number of bombs dropped, supplies airlanded, how quickly or how economically air power could perform tasks - had actually been standards of efficiency, whereas effectiveness was measurable only in terms of impact of the performance of a task on the enemy or the enemy's will to operate. Halting 90 percent of an enemy truck LOC would be less than 90 percent effective if the enemy only needed 5 percent of those trucks to sustain his operations.” See Robert F. Futrell, Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1961-1984 (Maxwell Air Force Base, AL: Air University Press, 1989) Vol. II, 322. Lieutenant Colonel Barry Watts touches on a related issue when he talks of the Air Force’s historic record of not taking friction into account in warfare. He argues that the Air Force has been inculcated with the sense that war is an “engineering project.” He goes on to say that “the bedrock error in traditional US air doctrine - the assumption that war’s essential processes can be precisely and exhaustively determined - is beyond redemption. Thinking about conflict in the United States would be better served by shifting toward a less mechanistic vision of war’s underlying processes.” See Lieutenant Colonel Barry D. Watts, The Foundations of US Air Doctrine (Maxwell AFB, AL: Air University Press, 1984), 110.

¹⁷ For good studies of how the enemy has been able to react to the effects of economic attack through substitution see Mancur Olson, Jr., The Economics of Wartime Shortage (North Carolina: Duke University Press, 1963) and Herman L. Gilster, The Air War in Southeast Asia: Case Studies of Selected Campaigns (Maxwell AFB, AL: Air University Press, 1993), 117-134.

¹⁸ In the past, it has been very difficult to judge how the enemy will react because of our tendency to “mirror-image.” Just because we might think *we* could not react in a certain way to an attack does not mean the enemy could not.

¹⁹ We must understand that this model is not an attempt to produce a “checklist” mentality in targeting, nor it is in any way meant to be predictive in nature. Nor is the model an attempt to define a specific set of conditions necessary before a particular target system should be hit. Any attempt to say, for example, that “if these conditions exist, then you should (or should not) target” a specific system is unwise, for every situation will be unique.

Chapter Three

World War II: The Transportation Plan

“Throughout the struggle, it was in his logistical inability to maintain his armies in the field that the enemy's fatal weakness lay...Reinforcements failed to arrive, weapons, ammunition, and food alike ran short, and the dearth of fuel caused their powers of tactical mobility to dwindle to the vanishing point. In the last stages of the campaign they could do little more than wait for the Allied avalanche to sweep over them.”²⁰

- General Dwight D. Eisenhower

After World War II, airpower theorists noted that the strategic bombing campaign against Germany failed to achieve its hoped for objective of forcing a surrender because of the numerous diversions of strategic bombing assets to other tasks.²¹ One of the most bitterly fought diversions occurred in the months leading up to the planned Allied invasion of the continent in the debate over the Transportation Plan. There was a strong difference of opinion between the transportation advocates and the strategic bombing advocates over the destruction-outcome linkage.

We begin the chapter with a discussion of airpower development. In the period between the two world wars, airmen developed the ideas and theories that would form the foundation of airpower application of World War II. This period saw the rise of strategic bombing theory and its destruction-outcome justification. Then we will review the events leading up to the execution of the Transportation Plan followed by a brief explanation of the results achieved. Finally, we analyze the results of the Transportation Plan using the Destruction-Outcome Model.

Interwar Development of Airpower

During the interwar period, airpower theorists grappled with the fundamental question of how to most effectively apply airpower. Was it more effective to bomb the

sources of the enemy's will and capability to fight or to support the Army in defeating the enemy's fielded forces? The first theorist to systematically address and document this issue was Guilo Douhet.²² As we will see, Douhet established a linkage between destruction and outcome defined in only first-order and fourth-order effects. He gave no consideration to second- and third-order effects in his linkage. Moreover, he overestimated the capability of airpower to inflict first-order effects -- a mistake that U.S. airpower theorists would repeat.

Douhet envisioned that, "Aerial offensives will be directed against such targets as peacetime industrial and commercial establishments; important buildings, private and public; transportation arteries and centers; and certain designated areas of civilian population as well."²³ A nation subjected to such aerial offensives would quickly see its will to fight broken and the people would rise up to demand their government end the war.²⁴ The capitulation of Germany in World War I, with an unbeaten army in the field, formed the basis for his belief in the brittle nature of national will.²⁵ In essence, Douhet had established a very simple relationship between the destruction of "vital centers" and the outcome of breaking national will. This connection assumed that first-order effects such as destruction of city structures and killing people *would* produce the fourth-order effect of broken national will with no consideration of the adversary's ability to react at the second- and third-order levels. In the U.S., the Air Corps Tactical School (ACTS) adopted and refined the basic Douhet theory.²⁶

By the early 1930s, strategic bombing theory and doctrine dominated the ACTS curriculum on employment of airpower.²⁷ The heart of the theory was taught in the "Air Force" course. In the lectures of this course, airmen such as Donald Wilson, Muir Fairchild, and Haywood Hansell argued that daylight, precision strategic bombing against the enemy's "industrial web" was the most effective use of combat airpower. The "Air Force" course explicitly described the fourth-order effect of strategic bombing -- breaking the will of the enemy.²⁸ The ACTS instructors and Douhet both believed in the

fragility of the enemy's will. Both had reached this conclusion by analogy with the World War I capitulation of Germany.²⁹ Where the ACTS diverged with Douhet was with the method by which airpower would break the will of the enemy.

Avoiding Douhet's concept of destroying cities, the ACTS advocated that destruction of the enemy's capability to wage war was the most effective way of breaking the enemy's will to fight. Besides the moral reluctance to indiscriminately bomb civilians,³⁰ ACTS instructors received information that the bombing of China by Japan had increased the morale of the people being bombed.³¹ Since the capability of an industrialized nation to wage war depended to a large degree on its ability to maintain its economic system and military forces, the ACTS instructors reasoned that the enemy's economic system was the key to getting at the will of the people.³² However, the naiveté of how easy it would be to accomplish the paralysis of the economic structure and break the will of the people was demonstrated when ACTS instructor Major Muir Fairchild described how "100 well placed bombs (or perhaps fewer) accurately placed [sic] in our vital industrial area would instantly reduce us to the status of a second or third rate power, unable to equip or maintain our armed forces -- perhaps even unable to fully sustain our civilian population."³³ Like Douhet, the ACTS defined the linkage between destruction and outcome in terms of only first-order and fourth-order effects.

Although strategic bombing doctrine was dominant, the ACTS addressed tactical airpower doctrine.³⁴ They recognized the need to support the army and considered the conditions necessary for airpower to be most effective in that support. The ACTS understood that targeting the transportation system supporting the resupply of the enemy's fielded forces would aid ground forces engaged with the enemy.³⁵ However, if the strategic bombing advocates were correct, there would be no need for a land campaign. Strategic bombing of the "industrial web" promised victory through airpower.

Thus, on the eve of World War II, the Air Corps was ready to enter the war with the untested theory and doctrine of unescorted, daylight precision bombing. The theory

assumed a *fourth-order* effect of breaking the will of the enemy population to fight could be achieved by *first-order* destruction of the “industrial web.”³⁶ The mechanism was the “collapse of the industrial machine by the destruction of some vital link or links in the chain that ties it together.”³⁷ Thus, with a strategic bombing force of sufficient size, it would only be a matter of time before the enemy’s will to fight would be broken.

Prelude to the Transportation Plan

Immediately before and during the early years of World War II, airmen viewed transportation as one of the vital links in the economic structure of Germany. Both Air War Planning Document-1 (AWPD-1), produced in August 1941, and, AWPD-42, produced one year later, identified transportation as a principal target.³⁸ However, by March 1944, attacking transportation in Germany, especially its rail system, was seen as an undesirable target for strategic bombing. A primary cause for this change was due to the analysis of a group known as the Committee of Operations Analysts (COA).³⁹ The COA was to play an instrumental role in advancing targeting theory beyond the simplistic assumptions of the Douhetan/ACTS destruction-outcome linkage.

General Henry “Hap” Arnold officially created the COA on 9 December 1942.⁴⁰ General Arnold tasked the COA to determine the earliest possible date airpower could weaken Germany enough to permit invasion of the continent. The group consisted of several USAAF officers from the Management Control section of the Air Staff, and leading national economists and industrialists.⁴¹

On 15 December, the COA decided to divide the German target systems into three categories based on how quickly destruction would reduce German military power.⁴² The COA assigned transportation to the highest priority category, Priority A. The COA divided into sub-committees for each of the target sets in the A and B priority categories. The sub-committees evaluated their assigned target system based on two questions. First, what would be the economic effect of the destruction of the target system and, second, how much force would be required to destroy the target system.⁴³

To answer the first question required access to a different type of information -- strategic intelligence. Answering the second question required accurate empirical evidence about the effectiveness of weapon systems against various types of targets. Both of these questions together suggest an approach based on the assumption that *airpower could destroy the target system*. The question was *how much force* was required to do it. Using these computations, they would try to maximize economic effect by finding target systems that took minimum force to destroy.

In a series of meetings in quick succession, the Sub-committee on Transportation, led by Dr. Ralph J. Watkins, reported on the progress of their analysis.⁴⁴ By 31 December, Dr. Watkins' analysis indicated that a "breakpoint" in the transportation system would require the destruction of at least 17,500 locomotives, and the attack of an additional 200 fixed sites that would have to be attacked repeatedly.⁴⁵ By 13 January 1943, the Transportation Sub-Committee concluded that, "At no point did the transportation system appear to offer a field of objectives within the scope of any projected operating air force." They based their conclusion on the large number of targets within the transportation system that would have to be destroyed, the capability to repair damage, and amount of airpower assets projected to be available.⁴⁶ This analysis shows the Transportation Sub-committee had made a significant refinement in relating cause to effect by considering second-order effects. The projected capability to apply force could not be accomplished at a rate faster than the adversary's ability to recover by repair and work-arounds. Given the projected amount of force available, attacking the transportation system was not as effective as hitting other target systems with a higher payoff. Consequently, the COA relegated the transportation system to a lower priority. This perception formed the foundation of the argument against targeting transportation with strategic bombers.

General Arnold wanted the COA to produce a comprehensive report in time for the Casablanca Conference (14-24 January 1943). The COA was unable to produce such

a report, but was able to submit two documents for use by American leaders at the conference. The first was a memo on “Interim Bombardment Objectives in Axis Europe.”⁴⁷ The COA asserted that “selecting a small number of targets for complete destruction rather than many for a little destruction” was the best way to target Germany.⁴⁸ The results would accumulate with the British bombing by night and the U.S. bombing by daylight and this “bombing can make a significant maybe even decisive impact on economy of Germany.”⁴⁹ The second document, a memo titled “Western Axis Oil Industry,” explained the COA’s view on the significance and vulnerability of the oil as a target system.⁵⁰ The COA felt oil was a particularly appealing and vulnerable target given its importance to Germany’s war effort and its concentration in a relatively few sites.

The Casablanca Conference produced the political direction and the desired outcome for the air offensive against Germany:⁵¹

To bring about the progressive destruction and dislocation of the German military, industrial and economic system and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened.

The directive also listed the target systems to be attacked. Because of the impact of the German submarines against merchant shipping, the German submarine construction yards were placed at the top of the list. This was followed by the German aircraft industry, transportation, oil plants, and other targets of war industry.⁵²

By 25 March 1943, the COA completed its final report. In this report,⁵³ the COA made the following points: 1) It could not predict the date by which the Germans would be weakened enough to permit invasion because of too many unknowns, 2) Results of attacks are cumulative and the plan should be adhered to with relentless determination, 3) It is better to cause a high degree of destruction in a few really essential industries or services than to cause a small degree of destruction in many industries⁵⁴ and 4) They

would not provide a prioritized list of target systems, but offered a set of criteria for determining priorities.⁵⁵

It is this set of criteria for determining targeting priorities that distinguished the analysis of the COA from other efforts. It consisted of the following considerations: (a) the indispensability of the product to the enemy or to the enemy war economy; (b) the enemy position as to current production, capacity for production and stocks on hand; (c) the enemy requirements for the product for various degrees of activity; (d) the possibilities of substitution for the product; (e) the number, distribution and vulnerability of vital installations; (f) the recuperative possibilities of the industry; (g) the time lag between the destruction of the installations and the desired effect upon the enemy war effort. This list represented some key considerations for determining how the enemy might respond to first-order effects. The question is whether their *application* of these considerations was accurate. Proper application of these considerations required access to *accurate* strategic intelligence about the German transportation system that the COA did not have at the time.

The COA final report formed the basis for the air plan to meet the Casablanca tasking. General Eaker briefed the plan in Washington⁵⁶ and the Combined Chiefs of Staff (CCS) approved it on 18 May 1943 during the Trident Conference.⁵⁷ This plan became known as the Combined Bomber Offensive (CBO). The CCS specified a prioritized target list of six systems with a total of 76 precision targets from those proposed by the COA.⁵⁸ These six systems were: 1) Submarine construction yards and bases, 2) Aircraft industry, 3) ball bearings, 4) oil, 5) synthetic rubber, and 6) military transport vehicles.

Summarizing, the COA had the most significant influence on setting the course of targeting in the CBO. This influence effectively removed the German transportation system as a primary strategic target in the CBO. Based on the available strategic intelligence, it would not be possible to inflict the necessary level of first-order

destruction on the transportation system with the projected available resources. The difficulty of attacking transportation, in combination with the institutional priority of the USAAF to prove the efficacy of strategic bombing, formed the foundation for a vigorous debate over the best way to use strategic airpower to ensure the success of Overlord.

Transportation versus Oil - The Debate

The CBO targeting priorities meant that the German transportation system in Western Europe would be largely unscathed except for whatever damage might occur as a result of British area bombing, or collateral damage from U.S. precision bombing. As of 1 March 1944, transportation was not a limiting factor in the functioning of the German war industry.⁵⁹ However, with the invasion of the continent rapidly approaching,⁶⁰ a plan to target the transportation system supporting German forces in France sparked an intense debate over how to best use the Allied strategic bombers in the time remaining.

On one side of the debate were General Carl Spaatz, commander of the U.S. Strategic Air Forces (USSTAF),⁶¹ and Air Marshal Arthur Harris, commander of Bomber Command. Opposing them were Air Chief Marshal Arthur W. Tedder, deputy to General Eisenhower and Air Chief Marshal Sir Trafford Leigh-Mallory, commander of the Allied Expeditionary Air Force (AEAF). Spaatz saw German oil production as the key target for USTAAF effort. Furthermore, Spaatz wanted to avoid further diversion of the CBO effort against targets not related to the strategic defeat of Germany. Harris lined up against the Transportation Plan because he believed it would not make any impact.⁶² Tedder and Leigh-Mallory wanted the USTAAF and British bombers to strike the marshaling yards in northern France and Belgium to reduce the Germans' ability to reinforce the invasion area in an operation known as the Transportation Plan.⁶³

Both sides called in their respective targeting experts to provide evidence for their case. Tedder relied on Solly Zuckerman.⁶⁴ Zuckerman's analysis of the Sicilian and Southern Italian rail systems led him to conclude that air attacks had paralyzed the

systems by the end of July 1943.⁶⁵ Using this analysis, Zuckerman convinced Tedder of the effectiveness of airpower against railway systems. Additionally, the AEAFF favored the Transportation Plan. The AEAFF thought it would contribute to the success of Overlord for the following reasons: 1) six of the nine German divisions available in France and the low countries were to move by rail, four of them from the northeast, 2) the north of France was the main source of railroad coal, and 3) attacks in the area would aid in deceiving the enemy regarding the invasion area.⁶⁶ For these reasons, Transportation Plan advocates believed it offered the best probability of ensuring that the Allied forces would be able to build up at a faster rate on the Normandy beachhead than the Germans could reinforce their defense.

Spaatz used the analysis of several groups to support his argument. The COA, in early March 1944, submitted its prioritized list of bombing targets to support Overlord as follows:⁶⁷ 1) Petroleum, 2) German Fighter Industry and Ball Bearing Industry, 3) Rubber Production, Tires and Stocks, 4) Bomber Production, and 5) Last Resort Targets: Transportation centers in Germany. Other targeting analysis groups⁶⁸ believed that the Transportation Plan would not degrade the rail system enough to stop the Germans from getting the necessary troops and supplies to the invasion area.⁶⁹ The rationale used to justify the ineffectiveness of the Transportation Plan was almost exactly the same as that used by the COA a year earlier to dismiss the German transportation system as a priority target. There were too many targets and not enough assets to overcome the enemy's ability to adjust. Furthermore, the USSTAF and the Ministry of Economic Warfare viewed the Transportation Plan as "abhorrent."⁷⁰

Unable to reconcile their differences, Eisenhower decided the issue in a meeting on 25 March.⁷¹ Eisenhower evaluated each side of the argument based on one critical question: Which plan contributed the most to assuring a successful invasion? When pressed for details on when the oil attacks would produce an effect on the German forces in France, the oil advocates estimated it would take four to five months.⁷² On the other

hand, although there was some uncertainty about the magnitude of the effect produced by the Transportation Plan, there was no uncertainty that there would be *some* effect.⁷³ Any effect in degrading German ability to redeploy forces to the Normandy assault area, however uncertain in magnitude, was better than no effect. Eisenhower decided in favor of the transportation plan.⁷⁴

Execution of the Transportation Plan

All USSTAF and Bomber Command assets were transferred Eisenhower's control on 14 April.⁷⁵ The first attack by USSTAF strategic bombers on a transportation target occurred on 21 April.⁷⁶ By the time D-Day arrived on 6 June, Bomber Command, the USSTAF, Ninth Air Force, and the British Second Tactical Air Force had dropped 82,500 tons on the rail system in France and Belgium. This tonnage is broken down by level of effort by each component and by type of target in Tables 1 and 2, respectively.

Component	Tonnage	Percent of Total
Bomber Command	46,500	56.4
USSTAF	24,500	29.7
Ninth Air Force	9,500	11.5
Second TAF	2,000	2.4
Total	82,500	100.0
Table 1 ⁷⁷		

Target	Tonnage	Percent of Total
Bridges	4,400	5.3
Rail Cuts	800	1.0
Marshaling Yards	71,000	86.1
Other	6,300	7.6
Total	82,500	100.0
Table 2 ⁷⁸		

Allied airpower delivered an average of 700-800 tons on 80-100 rail centers. The maximum dropped on any one marshaling yard was 3400 tons. It took an average of 155 tons to destroy a bridge using fighter-bombers and 310 tons using heavy bombers.⁷⁹

During the execution of the Transportation Plan, the AEA discovered destroying bridges was easier than previously thought. At the urging of Spaatz, the Ninth Air Force conducted an experiment against bridges using P-47s.⁸⁰ On 7 May, a flight of eight P-47s dropped a 650-foot railway bridge over the Seine. Three days later, Leigh-Mallory directed AEA fighter-bombers to begin attacking bridges.⁸¹ To maintain the deception plan, the bridge attacks were phased by starting in northern France, and moving south as D-Day neared. By D-Day, all the Seine bridges leading to Normandy had been physically or functionally destroyed.⁸²

Analysis

The D-Day invasion was successful. Not all the success can be solely attributed to Allied airpower. At least part of the reason for Germany's failure to respond was self-inflicted. Hitler was slow to release key units from the Calais area because he believed the actual invasion was going to take place there.⁸³ However, even if Hitler had released the units sooner, it is questionable whether they could have deployed quickly enough. Throughout the invasion, units trying to deploy to the Normandy area experienced significant delays. For example, it took two Panzer divisions as long to get from Eastern France to Normandy as it did from the Eastern Front to Eastern France.⁸⁴ Regardless of Hitler's errors, Germany's failure to defeat the invasion is evidence that airpower had created some adverse condition in its military capability to respond.

The question of exactly what conditions airpower had created and how has been argued about continually over the years since the invasion. Some asserted that it was a lack of fuel because of the number of vehicles found abandoned. However, the evidence shows the Germans did not suffer from a shortage of fuel in France. The problem for the Germans was an inability to distribute the available fuel effectively due to attacks on the transportation system.⁸⁵ After the war, senior German officers questioned about the effects of attacking transportation confirmed the finding that the Germans had plenty of fuel, but could not ship it to the front lines.⁸⁶ Complete air superiority over the invasion

area also had an impact. Field Marshal Karl von Rundstedt, Commander-in-Chief West, said that, "After the first few days, I had no hopes of defeating the invasion. The Allied air forces paralyzed all movement by day, and made it very difficult even at night."⁸⁷

Finally, there was the issue of whether attacking the marshaling yards or bridges was the most effective in contributing to the delay of units ordered to counter the invasion. As the Allies liberated France, both the American and British analysts obtained access to information about the transportation system. The Americans argued that the decisive factor was the attack of the bridges with fighter-bombers.⁸⁸ The Army Air Force Evaluation Board (AAFEB) suggested that the tonnage dropped by strategic bombers on marshaling yards had been wasted.⁸⁹ The Germans simply assembled their trains in Germany and ran them straight through to their destination, bypassing the need for the French marshaling yards. The real delay for German forces trying to redeploy, according to the AAFEB, occurred after detraining.

The British analysis painted a different picture. Zuckerman, using the official French railway records, argued that bombing the marshaling yards had an immediate effect on the rail traffic and showed a continuous decline in capacity with time.⁹⁰ To Zuckerman, not only had the attack on the marshaling yards yielded the desired reduction in German resupply and redeployment capability, but also it also brought the French railway system to verge of collapse. Zuckerman thought he had found the key to breaking the German economy -- attack their marshaling yards to disrupt the flow of coal to industry.⁹¹ German industry would not be able to function and the economy would come to a halt without coal.

Ultimately, it was not a case of either marshaling yards *or* bridges causing the breakdown of the transportation system, but a combination of the two. The reduction of the capability of the transportation system, in conjunction with many other factors, such as total Allied air superiority, Hitler's strategic blunders, and an effective deception operation contributed to the success of the invasion. In other words, the success of the

transportation plan created a third-order effect that, along with other the other third-order effects, resulted in achieving the fourth-order effect of a successful invasion.

The Transportation Plan advocates had more effectively linked destruction to outcome. As the first-order effects accumulated on successive marshaling yards, there would be a decreasing capability to re-route traffic. Airpower would inflict damage at such a rate to out-pace repair of first-order destruction. Switching to a different mode would be difficult because of the sheer inefficiencies of transporting large quantities of materiel by road. Furthermore, road travel, like rail travel, was subjected to constant attack. In sum, the Transportation Plan was designed to produce a downward spiraling capability to move and support combat units into the assault area.

The German military strategy relied on stopping the Allies on the beaches. Once the transportation system was unable to support this strategy, the most prudent action for the Germans would have been to resynchronize operations with the available transportation. Instead, the Germans chose to commit inadequately supported units to battle at a slower rate than the Allies were able to bring well-supported forces ashore. The Allies had defeated the German military strategy for defending against an invasion.

Summary

In this chapter, we have presented the development of interwar theory and doctrine within the Air Corps, specifically, the efforts of the ACTS. It was the ACTS theory and doctrine, as well as institutional factors, that influenced the understanding of destruction and outcome. The ACTS destruction-outcome relationship, like Douhet's, lacked an appreciation for enemy reactions to second- and third-order effects. We then examined how the COA evaluated the German transportation system. The limitations of airpower technology at the time, the large set of targets, and poor strategic intelligence led the COA to dismiss the transportation system as a viable target set for strategic attack. However, the COA did develop a set of innovative criteria for linking destruction to second-order effects and, in doing so, considered how the enemy might react to the

attacks. Finally, we looked at the Transportation Plan, its execution, results, and adherence to the Destruction-Outcome Model. The U.S. airmen fought the Transportation Plan vigorously. Much of this opposition had to do more with the desire to prove the efficacy of strategic bombing theory and less to do with keen analysis of relating destruction to outcome. In the next chapter, we will analyze an air campaign against transportation in which the linkage between destruction and outcome was less clear -- Operation Strangle.

Notes

²⁰ General Dwight D. Eisenhower, "Report by The Supreme Commander to the Combined Chiefs of Staff on the Operations in Europe of the Allied Expeditionary Force: 6 June 1944 to 8 May 1945," 13 July 1945, 121, AFHRA File No. 168.7045-51.

²¹ Among the tasks were supporting the invasion of North Africa and the Battle of the Atlantic. In a 1985 interview, General Curtis E. LeMay stated that "the ground officers were far more interested in preparing for the ground war than strategic bombing...he believed this was a mistake and that the war in Europe could have been won with the proper use of strategic bombing... this would have eliminated the need for a ground invasion." See Major Brit M. Sturdy, "U.S. Strategic Target Selection of German Resources in WW II," Air Command and Staff College Research Report, Maxwell AFB, AL, 1985, 29. Major General Haywood Hansell echoed the same sentiments about diversion of assets. See Major General Haywood S. Hansell Jr., The Strategic Air War Against Germany and Japan (Washington, DC: Office of Air Force History, 1986), 94-95.

²² During World War I, there were a number of people who arrived at some of the ideas Douhet expressed, but it was Douhet who produced a thorough argument for the use of airpower. The most famous American advocate of the Douhetan ideas was Brigadier General Billy Mitchell. See William Mitchell, Winged Defense (New York: Putnam, 1925).

²³ Guilo Douhet, Command of the Air (Washington, DC: Office of Air Force History, 1983), 20.

²⁴ Ibid., 22-23, 58. As we will see in Chapter Six, this mechanism was echoed by planners in Desert Storm.

²⁵ Ibid., 126.

²⁶ The influence of Douhet on the development of ACTS strategic bombing theory is open to debate. The ACTS lectures from the 1930s are not pure academic works and do not cite references. According to Robert F. Futrell, it seems clear that Air Service officers had received translated portions of Douhet's Command of the Air as early as 1923. See Robert F. Futrell, Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, 1907-1960 (Maxwell AFB, AL: Air University Press, 1989) Vol. I, 39. On the other hand, ACTS instructors whose names are closely associated with the doctrine deny any influence of Douhet's works and insist they arrived at their theory independently. During an interview, Major General

Donald Wilson was specifically asked about the influence of Douhet on ACTS development of doctrine. He said the ACTS did not use any of the Douhet material and that he was solely responsible for developing the concepts strategic bombing by himself. See Hugh N. Ahmann, "Interview of Major General Donald Wilson," 10-11 December 1975, 43, AFHRA File No. K279.0512-878. Colonel Guido Perera specifically credits Muir Fairchild with developing the framework used to approach the problem of finding the vulnerable points in an industrialized nation when he was an instructor at ACTS. Fairchild "had the opportunity to weigh the theories of Mitchell and Douhet and to integrate them with existing trends in weapons." Fairchild had "about the year 1932" started a study of the U.S. to determine points of vulnerability to air attack. See Colonel Guido Perera, "History of the Organization and Operations of the Committee of Operations Analysts (16 November 1942 thru 10 October 1944)," 1944, 1-2, AFHRA File No. 118.01 v.1. (Hereafter referred to as "History of the COA")

27 Robert T. Finney, History of the Air Corps Tactical School (Washington, DC: Center for Air Force History, 1992), 62-68. Also see David MacIsaac, "Voices from the Central Blue: The Air Power Theorists," Makers of Modern Strategy, ed. Peter Paret. (Princeton, NJ: Princeton University Press, 1986), 633.

28 See Major Muir S. Fairchild, "The Aim in War," Lesson for the "Air Force" Course at the Air Corps Tactical School, 1939, 16, AFHRA File No. 248.2021A-1 v.1. Fairchild states, "The ultimate aim of all armed forces is to break down the enemy's will to resist."

29 Ibid., 8-9. The use of the World War I experience of Germany in ACTS arguments is clear with passages such as this: "it is only natural to find that under any form of government, the will to resist, the will to fight, the will to achieve, are all centered in the mass of the people. Ultimately, defeat is determined by the breakdown of the will to continue the fight of the citizens at home. If there can be any question of the truth of this statement, we have only to consider the last war for verification...Defeat [for Germany in WWI] was finally admitted because the people at home had lost their willingness to fight."

30 General Douglas MacArthur expressed the feeling that "the sentiment of this country...will always repudiate and forbid the unprovoked initiation of this kind of war [targeting unarmed civilian centers of population and industry] by our own forces." See John F. Shiner, Foulois and the U.S. Army Air Corps: 1931-1935 (Washington, DC: Office of Air Force History, 1983), 220.

31 Major Muir S. Fairchild, "National Economic Structure," Air Corps Tactical School Lecture, Maxwell AFB, AL, 1939, 5, AFHRA File No. 168.7001-31.

32 Ibid.

33 Memo from Major Muir S. Fairchild to General Henry Arnold dated 7 June 1940, Forwarding Air Corps Tactical School lecture titled "National Economic Structure", AFHRA File No. 168.7001-31.

34 See Major F.M. Hopkins, "The Influence of Air Power on Land Warfare," Lesson for the Air Force Course at the Air Corps Tactical School, 1939, AFHRA File No. 248.2021A-1 v.1.

35 Ibid., 12-16

36 There were a number of others, see MacIsaac, 635.

37 Fairchild, "National Economic Structure," 6.

³⁸ AWPDP-1 cited “dislocation of the German transportation system” as one of the three primary target systems to be attacked to collapse the German economic structure. The other two were electricity and oil. The purpose of AWPDP-42 was to update AWPDP-1 to reflect the possible impact of Russia being defeated by the Germans. See Major General Haywood S. Hansell Jr., The Air Plan That Defeated Hitler (Atlanta, GA: Higgins-McArthur/Logino & Porter, Inc., 1972) , 80, 102-105.

³⁹ There were other groups doing analytical work on targeting Germany. These include the Enemy Objectives Unit (EOU), operating out of the American embassy, and staffed with members of the Office of Strategic Studies, and a British group called the Ministry of Economic Warfare (MEW).

⁴⁰ Perera, “History of the COA,” 7a. This group was initially known as the “Advisory Committee on Bombardment.”

⁴¹ Hansell, The Air Plan That Defeated Hitler, 148. Hansell relates how Muir Fairchild had convinced Arnold that this type of group would be beneficial because “the recommendations of such a group would carry great weight with the Secretary of War and the President.”

⁴² Perera, “History of the COA,” 7a-8. The actual description of priorities is as follows:

Priority A: Those which on grounds of indispensability or vulnerability and direct relation to German capacity to resist invasion appear to offer most promise as targets in the sense that they would bring about the most rapid deterioration of enemy military power in the year 1943.

Priority B: Those elements in the German military and economic potential which would be seriously affected by attrition over a longer period of time.

Priority C: Those items in the German economy which, however important in themselves, offered unsatisfactory targets or which could be affected only indirectly by some such method as interference with transportation, electric power, sources of raw material or otherwise.

⁴³ Perera, “History of the COA,” 12.

⁴⁴ Ibid., 12. Dr. Watkins worked on the National Resources Planning Board and had recently prepared an overall study on the U.S. transportation system for President Roosevelt.

⁴⁵ Ibid., 18. Unfortunately there is no explanation as to how the Transportation Sub-Committee came up with these numbers. Nor is there an explanation of what the economic impact would have been if the transportation system were destroyed.

⁴⁶ Ibid., 27.

⁴⁷ Perera, “History of the COA,” v.2, Tab 6.

⁴⁸ Ibid.

⁴⁹ Ibid.

⁵⁰ COA Memo on Western Oil Axis Vulnerability, 1944, AFHRA File No. 118.01 v.2, Tab 7.

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- ⁵¹ Hansell, The Air Plan That Defeated Hitler, 153.
- ⁵² Ibid.
- ⁵³ This was the “final report” with respect to the original tasking General Arnold gave to the COA in his 9 December, 1942, memo. The COA worked on more projects related to target analysis before they broke up in October 1944.
- ⁵⁴ Albert Speer agreed with this approach. He thought that one of the biggest mistakes the Allies made was switching target sets before complete destruction. He cites this COA recommendation to concentrate on a few targets thoroughly instead of many only superficially. Speer said the “idea was correct, the execution defective.” See Albert Speer, Inside the Third Reich (New York: MacMillan, 1970) , 347.
- ⁵⁵ Memo to Lieutenant General Henry H. Arnold from the Committee of Operations Analysts, “Report of Committee of Operations Analysts with Respect to Economic Targets Within the Western Axis,” 1943, 2-3, AFHRA File No. 118.01 v.2, Tab 22. Although they did not intend to provide a prioritized list, the fact that the target systems were numbered gave the list a “de facto” prioritization.
- ⁵⁶ General Eaker’s presentation of the plan to the US Joint Chiefs of Staff can be found in Watts, 133-150.
- ⁵⁷ Perera, “History of the COA,” 46.
- ⁵⁸ AAF Historical Office, “US Air Force Historical Study No. 122: The Combined Bomber Offensive, 1 January to 6 June 1944,” Washington, DC, 1947, 8, AFHRA File No. 101-122.
- ⁵⁹ Office of the Assistant Chief of the Air Staff for Intelligence, “Report to the COA on European Axis Transport as an Air Target System: Estimates of the Air Attack on Axis Transportation,” Washington, DC, 17 June 1944, 1, AFHRA File No. 142.042-24 v.2. This was verified in post-war analysis as well. See United States Strategic Bombing Survey: Transportation Division, The Effects of Strategic Bombing on German Transportation, Second ed. 1947) Vol. 200, 2.
- ⁶⁰ The date for invasion was established as 1 May, 1944 at the TRIDENT Conference held in Washington, DC, in May, 1943. James Parton, Air Force Spoken Here (Bethesda, MD: Adler & Adler, 1986), 263.
- ⁶¹ The USSTAF was created to ensure the AAF could control all of the strategic assets in Europe. This was to counter the desires of the army theater commanders in Italy and England who wanted control of all of the air assets in the respective theaters. If the theater commanders controlled the airpower assets, then the prosecution of the CBO would have been adversely affected. Richard G. Davis, Carl A. Spaatz and the Air War in Europe (Washington, DC: Center for Air Force History, 1993), 266-280.
- ⁶² Marshal of the R.A.F. Sir Arthur Harris, Bomber Offensive (New York: MacMillan, 1947), 197. Harris thought that railways were “extraordinarily difficult and unrewarding targets for air attack. Main lines can be repaired in a few hours, and through lines in wrecked marshalling yards in a few days.”
- ⁶³ Lord Tedder, With Prejudice (London: Cassell & Company, Ltd., 1966), 506; Davis, 330-335, 345-353.

⁶⁴ Tedder had been very impressed with the work of Zuckerman. Zuckerman was a professor of anatomy by training who was studying the effects of blast on buildings and the human body before working for Tedder. He began working for Tedder during the Sicily campaign in an operational research role. Zuckerman had served as the scientific advisor to the Mediterranean Air Force and was part of the “Bombing Survey Unit” that gathered evidence for analyzing bombing effectiveness in the Mediterranean theater. According to Tedder, Zuckerman “made a most thorough analysis of the nature and construction of the defenses, the types of bombs and fusing needed, the standards and accuracy of the various types of squadron. On this analysis the bombing programme was organized.” See Lord Tedder, 441.

⁶⁵ Solly Zuckerman, “Air Attacks on Rail and Road Communications,” 28 December 1943, ii-vii, AFHRA File No. 519.425-1

⁶⁶ Army Air Force Evaluation Board in the European Theater of Operations, “Effectiveness of Air Attack Against Rail Transportation in the Battle of France,” 1945, 6-7, AFHRA File No. 138.4-37 (Hereafter referred to as AAFEB, “Effectiveness”)

⁶⁷ Memo to General Hansell from Colonel Guido Perera, “Plan for the Completion of the Combined Bomber Offensive of 5 March 1944,” 12 March 1944, 1, AFHRA File No. 118.01 v.2, Tab 77.

⁶⁸ The Enemy Objectives Unit operating out of the American embassy in London and British Ministry of Economic Warfare.

⁶⁹ AAFEB, “Effectiveness,” 7.

⁷⁰ Perera, “History of the COA,” 104.

⁷¹ Davis, 349-352.

⁷² Ibid., 351.

⁷³ AAFEB, “Effectiveness,” 7; Lord Tedder, 519-521.

⁷⁴ Despite the decision by Eisenhower, Spaatz continued to “pursue his chief objective: the Luftwaffe and oil targets.” He was able to convince Eisenhower to allow strategic attacks against the German oil industry. Eisenhower permitted about 25% of the strategic bombing missions to be dedicated to oil targets. See Davis, 384-394; Hansell, The Air Plan That Defeated Hitler, 235-236.

⁷⁵ AAF Historical Office, 25.

⁷⁶ Davis, 393.

⁷⁷ Derived from AAFEB, “Effectiveness,” 8-9.

⁷⁸ Ibid.

⁷⁹ Ibid., and “Assistant Chief of the Air Staff, Intelligence: Overlord - The Interdiction Campaign, Tab B,” 1944, 3, AFHRA File No. 142.042-24 v.1.

⁸⁰ Wesley Frank Craven, and James Lea Cate, The Army Air Forces in World War II. Europe: Argument to V-E Day (January 1944 to May 1945) (Chicago: The University of Chicago Press, 1951) Vol. 3, 156-157.

⁸¹ Ibid., 158. Given that it took an average of 150 tons for fighter-bombers to drop a bridge during the transportation campaign, and that the minimum amount of tonnage to drop a bridge throughout the transportation campaign was reported as 29 tons, one might question how the eight P-47s dropping a total of 8 tons of bombs were able to do such damage to this bridge.

⁸² Davis, 410.

⁸³ John Keegan, The Second World War (New York: Penguin Books, 1989), 382-389.

⁸⁴ AAF Historical Office, "Study No. 122", 170-171.

⁸⁵ Assistant Chief of the Air Staff for Intelligence, "Evaluation of Transportation as an Air Target: A Summary of European Experience," 4. and "Assistant Chief of the Air Staff, Intelligence: Overlord - The Interdiction Campaign, Tab B," 4-6.

⁸⁶ "Assistant Chief of the Air Staff, Intelligence: The Winter Campaign, Tab D," 8.

⁸⁷ Air Commodore Jasjit Singh, Air Power in Modern Warfare (New Delhi: Lancer International, 1985), 151; Sir Arthur Harris quotes a German officer on the effect of targeting transportation, "You could undoubtedly have landed on the Continent, but it is highly doubtful whether you could have remained there if our transportation system had not been shattered. Any landing is possible; the problem is moving reserves and material at the right moment to the right place." See Harris, 209.

⁸⁸ Craven and Cate, 156-157. "Probably the decisive phase of the long transportation program was the brilliantly successful interdiction campaign against bridges."

⁸⁹ Army Air Force Evaluation Board in the European Theater of Operations, "Summary Report on Effectiveness of Air Attack Against Rail Transportation in the Battle of France," 1945, 36, AFHRA File No. 138.4-37A.

⁹⁰ AAFEB, "Effectiveness," 5.

⁹¹ Alfred C. Mierzejewski, The Collapse of the German War Economy, 1944-1945 (Chapel Hill, NC: University of North Carolina Press, 1988), 100. U.S. intelligence had also reported on the impact to the French economy and the problems of distributing coal. It noted that by early May, 1944, there had been a "major impact on support of German war economy." See Office of the Assistant Chief of the Air Staff for Intelligence, "Report to the COA on European Axis Transport as an Air Target System: Estimates of the Air Attack on Axis Transportation," Washington, DC, 1944, 5, AFHRA File No. 142.042-24 v.2.

Chapter Four

Korea: Operation Strangle

“There is no positive approach in the thinking of the Air Force toward driving the attack to a successful conclusion. The attitude of the Air Force seems to be that we will immobilize his air force, the enemy's air force, that is, render it ineffective. Finally, we are going to punish that rascal until he surrenders. In other words, the Air Force, as a Service now, seems to be dedicated to the proposition that the military objective can be achieved through attrition alone. If we have no assurance that such a procedure will be successful, and we don't, then we as a Service will have no conception of how we propose to drive the attack to a successful conclusion.”⁹²

- Colonel William J. Cain, Jr.

The essence of Colonel Cain's point in the above quote, made shortly after the end of the Korean War, was that the Air Force did not effectively link destruction with desired outcome. He thought the Air Force was relying too much on the assumption that if it destroyed enough “things,” then it would achieve the desired fourth-order effect. Simply put, there was no clear and convincing explanation of the linkage between the first-order and fourth-order effect of attacking the enemy's target systems.

In this chapter, we will examine why Colonel Cain may have arrived at this conclusion by looking at why and how the Air Force targeted transportation in the Korean War in an air campaign called “Strangle.”⁹³ The Air Force attacked the transportation system supporting the communists continuously in the war. However, Strangle was the most concerted effort to destroy the transportation system and the Air Force prosecuted it with the hope of producing a fourth-order effect. It provides us with an excellent case study of the factors influencing the linkage of destruction with outcome. The events leading up to Strangle are presented, followed by the execution of the campaign. Finally, we analyze the results using the Destruction-Outcome Linkage Model.

Interwar Development of Airpower

During the period between the end of World War II and the Korean War, the Air Force focused on deterring, and if necessary, fighting a war against the Soviet Union. The combat effectiveness of airpower was strongly, if not overwhelmingly, influenced by the development of the atomic bomb. The sheer destructive power of the atomic bomb gave Douhet's theory of airpower increased credibility.⁹⁴ Nuclear weapons offered the potential to quickly destroy an adversary's industrial and economic capacity to support a war.⁹⁵ The result of this emphasis on a nuclear-based strategy and force structure was the neglect of conventional airpower and thinking about linking destruction to outcome.

With the strong belief in the efficacy of nuclear weapons delivered by strategic bombers, the Air Force expended most of its resources in that area.⁹⁶ In amount of effective tonnage delivered per dollar expended, no other weapon could compare to the nuclear bomb. Given the Truman administration's desire to keep defense spending to the absolute minimum, the atomic bomb dominated the Air Force.⁹⁷ The Air Force geared its training, equipment, force structure, and doctrine towards deterring, and if necessary, fighting a nuclear war against the Soviet Union.⁹⁸ Strategic Air Command was evolving into the nation's first line of defense and had priority on manpower and materiel.⁹⁹ It enjoyed not only the prestige associated with that role, but also an ever increasing share of the budget.

As civilian and military thinkers theorized about the nature of the next war, a strong belief emerged that the U.S. would fight the next conflict with nuclear weapons. For example, on 29 May 1947, the President's Advisory Commission on Universal Military Training reported it thought that, "World War III would begin with atomic sneak attacks against the United States."¹⁰⁰ The emergence of the Soviet Union as an ever increasing threat also helped fuel the emphasis on strategic nuclear forces. A survey of

the Air University Quarterly Review contents in the late-1940s reveals the pre-eminence of the strategic nuclear mission. Tactical airpower, although acknowledged as beneficial in supporting land campaigns, was of secondary importance.¹⁰¹ However, strategic bombing advocates again called into question the necessity of a land campaign in future conflicts. Thus, by the summer of 1948, one Air Force officer asserted that “if at any time, it appears that expenditures for tactical aviation will jeopardize development in strategic, the former will have to be sacrificed.”¹⁰²

In the technological arena, the U.S. made advances in a number of fields. Nuclear weapons research continued at a rapid pace to develop higher yield and smaller weapons. Jet engines were being improved constantly. There were improvements in weapons aiming technology and avionics. However, there was still little ability to achieve pinpoint accuracy in the weather or at night. With the destructive power of a nuclear device, pinpoint accuracy was not considered a necessity at the time.¹⁰³ Entering the 1950s, the ability of conventional airpower to inflict first-order destruction was not much improved over what existed in World War II.

The interwar period saw the new Air Force in transition. It was in transition from piston-driven aircraft to jets, from conventional munitions to nuclear weapons, from an appendage of the Army to an independent organization. What was not in transition was belief in the Douhetan and ACTS theory of breaking the will of the enemy by targeting the vital centers.¹⁰⁴ The wars of the future would not last years, or months, or even weeks in a drawn out affair of attrition warfare. At most, they would be over in days and probably it would be only a matter of hours.¹⁰⁵ With the destructive power of nuclear weapons, the impact of first-order destruction would most certainly result in a fourth-order effect. The inattention paid to conventional forces and to thinking about how to link first-order effects to fourth-order effects became apparent on 25 June 1950.

The Genesis of Strangle

The Korean war caught the U.S. off guard.¹⁰⁶ The Air Force faced an emergency that required quick action or the North Koreans would overrun the peninsula. However, the initial response of the Far East Air Force (FEAF) was somewhat chaotic. The neglect of tactical doctrine, force structure, and equipment, especially for close air support, was readily apparent.¹⁰⁷ There had been very little training among units in the Far East Command.¹⁰⁸ The primary mission of the FEAF was air defense.¹⁰⁹ Lack of attention to conventional forces and training degraded the ability of the FEAF to produce first-order effects.

Despite the initial poor performance of the FEAF, it was instrumental in stopping the North Korean Army (NKA) from overrunning the South Korean peninsula. A key to this success was the effectiveness of airpower in reducing the capability of the North Korean Army's transportation system. Based on 2000 POW interrogations, intelligence analysts concluded that, "When subjected to repeated and widespread damage and destruction, the Korean transportation network acted as a very definite limiting and delaying factor on the movement of supplies...the continuous delays caused by succeeding obstacles and detours and by the limited capacity of temporary bridges and rail lines constituted a very real brake on the enemy's logistical support of front-line units."¹¹⁰

The same intelligence report also noted the enemy reaction to second-order effects when it commented, "The North Koreans were very good at finding workarounds with the construction of underwater bridges or sandbagging the river bottom to allow military vehicles to cross. The enemy was able to get supplies through, but not without delay."¹¹¹ Brigadier General Charles Y. Banfill, Deputy for Intelligence, FEAF, stated that the North Koreans had an extremely low level of requirements for food and clothing, and they had incredible stamina and employment of raw manpower in the movement of supplies.¹¹²

Despite the evidence of workarounds to second-order effects, and the limited capability of conventional airpower to produce first-order effects especially at night or in the weather, FEAF planners focused on the transportation system. In essence, the planners believed a fourth-order effect, a decision by NKA leaders to withdraw, would occur if the second-order effect of the reduction of supplies was imposed, without fully considering the alternatives available to the enemy to deal with the second-order effects.

The FEAF planners noted that not only would attack of the transportation system reduce the flow of supplies to frontline troops, but it would also “serve to isolate and hinder the economy of North Korea.”¹¹³ This echoed one of the basic lessons identified in World War II about attacking transportation -- the strategic effect on the economy.¹¹⁴ The planners argued that once airpower sufficiently reduced the flow of materiel, the NKA would eventually exhaust its organic supplies and the supplies they had captured or appropriated from occupied areas. The implication was that the NKA would have to withdraw because attacking the transportation system would lower resupply quantities below necessary requirements. While this argument is logical, it is flawed in the sense that there was little, if any, evidence to support the notion that the available airpower assets could inflict enough first-order effects to produce second- and third-order effects. In other words, the airmen had overestimated their ability to produce first-order effects.

The sufficiency of the attack on the transportation system in creating a fourth-order effect was not tested because the UN forces began the counter-attack to drive the NKA back across the 38th parallel. After the Chinese Communists entered the war in November 1950 and drove the UN forces back into South Korea, the political objective was firmly established as the *status quo ante bellum*.¹¹⁵ In June 1951, as the armistice negotiations began, the front stabilized along a static line of defense near the 38th parallel.

At this point in the war, the Air Force looked for a way to coerce the communists. According to strategic bombing theory, airpower could not be used in its most effective

form by striking at the real sources of supply located in China and the Soviet Union.¹¹⁶ Therefore, the FEAF decided to try to choke off the resupply of the fielded forces by comprehensive and systematic destruction of the North Korean transportation system. The desired outcome of such an operation was to force the communists to retreat from the 38th parallel.¹¹⁷

Execution of Operation Strangle

The FEAF planners used the same reasoning discussed earlier about targeting transportation to produce a fourth-order effect to justify the Strangle campaign. Thus, the same disconnect with the Destruction-Outcome Linkage Model also existed. They failed to understand or appreciate how the enemy could react and adjust to the attack of the transportation system. Furthermore, they failed to understand the limitations of their airpower's capability to inflict first-order damage at a faster rate than the enemy could repair the damage or find work-arounds.

The Strangle campaign consisted of two distinct phases. The first phase was directed against road transportation between the 39th parallel and the front lines.¹¹⁸ This was done in conjunction with UN ground efforts to establish a line of defense near the 38th parallel. By mid-June, the UN had reached its objective at the 38th parallel. The ground war reached the stalemated position that would last for the remainder of the war.¹¹⁹

In the context of the stalemated ground war, FEAF planners formulated the second phase of Strangle. General Weyland, FEAF commander, believed that the UN did not have to accept the stalemated situation. Airpower, General Weyland argued, could be decisive in destroying the capability of the enemy to fight without a bloody ground offensive.¹²⁰ However, there were political restrictions on striking certain targets, such as the irrigation dams and hydroelectric plants, that would serve to limit the decisiveness of airpower. Within these restrictions, FEAF planners studied the North Korean target sets to find something worthy of a concentrated, all-out air offensive.

After careful study, the planners “determined that the North Korean rail-transportation system was of supreme importance to the Communists.”¹²¹ Using the available intelligence estimates, they computed it would take 6,000 trucks or 120 boxcars to transport the 2,400 tons needed every day to sustain the 60 communist divisions on the battlefield.¹²² Since coal was readily available to power the locomotives and motor fuel had to be imported, the planners reached their conclusion about the criticality of the railroad system in keeping the communist forces supplied at a minimum level.¹²³ Any attempt by the communists to resupply using road transport would be made too costly by a complementary program of truck-killing.¹²⁴

The stated goal of this operation was to keep the enemy from launching and sustaining an offensive.¹²⁵ However, FEAF leaders clearly thought a decisive result was possible by shutting down the transportation system. The logic that linked destruction to outcome went something like this: 1) the rail system could be “knocked out” by airpower, 2) once the rail system was shut down, the enemy would have to use roads for resupply, 3) using roads was not a viable option for the enemy because of the costs that would be inflicted by attrition of their trucks from air attack, and 4) this would result in “unbearable pressure” on the enemy, even without offensive ground action.¹²⁶ Colonel William McBride, the Fifth Air Force director of combat operations, echoed the desired outcome when he stated “that with this program we can force the enemy to retire [to a line] 100 miles from and parallel to the Yalu River.”¹²⁷

With the tenuous destruction-outcome linkage established, the second phase of Strangle, aimed primarily against the railway network, began on 18 August 1951. Using Fifth Air Force, Bomber Command, and Navy assets, the Strangle campaign aggressively targeted the North Korean rail system. However, it became apparent that the Strangle campaign was not going to achieve the goal of stopping railway and road traffic. By December 1951, the early optimism of Air Force planners and leaders had turned into

frustration. Intelligence reports indicated the communists were extremely resourceful in keeping the rail system working.¹²⁸

The communists used many effective countermeasures. They included:¹²⁹ protection of key positions with anti-aircraft weapons, building by-passes to eliminate or minimize vulnerable choke points, quick repair of cuts, running trains at night and hiding in tunnels, using shuttle operations between breaks, maximum use of repaired lines to eliminate back-up caused by air attack, and using truck traffic. Moreover, the assumption that airpower could make the cost of transporting supplies by truck unbearable for the communists did not hold up in actual operations. The communists compensated for attacks on the trucks by:¹³⁰ moving during the night, blacking out at first threat of air attack, hiding vehicles during the day, driving with minimum amount of light, and dispersing traffic along maximum number of routes. FEAF planners had vastly underestimated the enemy's ability to compensate for the attacks and not fully realized the limitations of their available conventional forces to produce first-order effects.

To overcome the communists' use of darkness as a countermeasure, FEAF devised a plan to strike a small number of rail segments around-the-clock. They put this plan, referred to as Operation Saturate, into effect on 3 March 1952, and continued until May.¹³¹ The plan was to hit a selected segment during the day with fighter-bombers and at night with B-26s. Although the tactic appeared more effective at keeping the lines out of service for longer periods than random rail cuts, Fifth Air Force had only enough fighter-bombers to keep one selected segment shut down.¹³² This left the other rail lines to pick up the slack. The FEAF simply could not inflict enough first-order damage with the available airpower assets.

During the Strangle campaign from 18 August 1951 until 18 March 1952, the amount of damage claimed on the enemy's transportation system was impressive. It included:¹³³ 15,003 rail cuts; 25,824 vehicles destroyed; 199 bridges made unusable; 3,262 pieces of rolling stock destroyed and 247 locomotives destroyed. The FEAF

aircraft losses incurred while executing Strangle amounted to 243 lost and 290 significantly damaged. Moreover, during same period, FEAF only received 131 replacement aircraft.¹³⁴ Thus, FEAF was losing aircraft at a faster rate than they were being replaced. Furthermore, despite the magnitude of the destruction to the transportation system, the enemy received the necessary amounts of supplies. The net effect of these factors was for FEAF leaders to concede futility of continuing the maximum effort attack on the transportation system.¹³⁵

Analysis

The Air Force was not prepared for the type of war fought in Korea. It had prepared to fight an all-out war using nuclear weapons against the most likely adversary - the Soviet Union. The emphasis on nuclear weapons left fewer resources available to acquire and develop conventional forces. However, the lack of resources was not the cause of the Air Force inadequately addressing the linkage of how destruction of targets contributed to the desired outcome. The cause can be partially attributed to the Air Force belief in the idea that if enough of the right “things” are destroyed, then the enemy will be compelled to quit.

There were restrictions in the execution of the war that reduced the effectiveness of airpower. This was the first limited war fought in the Cold War era. Both military and political leaders were trying to learn how apply military power in a coercive manner for what were essentially negative objectives.¹³⁶ President Truman expressed the primary negative objective when, in explaining his firing of General Douglas MacArthur, he said his goal was to prevent World War III.¹³⁷ President Truman’s political restrictions on the conduct of military operations included permitting the enemy a sanctuary, placing certain target sets in North Korea off-limits, and denying the use of nuclear weapons.

While the FEAF believed the restrictions prevented them from using airpower optimally, they did not think this prevented them from applying airpower decisively

against less than optimum target sets such as the transportation system. However, their justification for attacking the transportation system failed to link destruction to outcome. The FEAF planners overlooked several factors that limited the ability of airpower to inflict first-order effects.

First, there were technological shortfalls. The ability to deliver ordnance with pinpoint accuracy around-the-clock and in the weather did not exist in the Korean War. Without this capability, the enemy had large segments of time to compensate for the attacks by repair, movement, and use of alternate modes of transportation. If the FEAF fighter-bombers were to maximize the probability of destroying a segment of the transportation system, they had to attack during daylight hours in weather good enough to acquire the target visually and perform the delivery maneuver. With no standoff capability, the delivery maneuver required the pilots to fly within the lethal range of anti-aircraft artillery. This anti-aircraft artillery became increasingly effective as the communists learned to defend the weak points of their transportation system as evidenced by the FEAF aircraft losses.

Second, there was not enough force structure in theater to inflict the necessary amount of damage on the transportation system to compensate for the technology shortfalls. From the start, the Air Force was reluctant to commit more aircraft to Korea, especially at the expense of forces dedicated to European defense.¹³⁸ The result was that the force structure of FEAF was insufficient to deliver the necessary damage to the transportation system.

Finally, the lack of a centralized air commander reduced the effectiveness of the available airpower assets. The Air Force and Navy each had differing perceptions about the use airpower and one service was not going to be subservient to the other.¹³⁹ Each, it seemed, went about its business with its own priorities as a main driver of targeting. The FEAF did not even invite the Navy to attend their Formal Target Committee Meetings until the last month of the war.¹⁴⁰

The FEAF planners' failure to realize the impact of these factors caused them to overestimate the capability to produce first-order effects. Furthermore, they did not adequately consider how the enemy could compensate for second- and third-order effects even though there was intelligence information available about how they might. The result was that the Strangle air campaign was unable to produce the desired outcome because the FEAF planners had not made the destruction-outcome linkage. Airpower did not knock out the transportation system as planned.¹⁴¹ The Strangle campaign simply could not inflict damage on the enemy's transportation capability to the point where they would be unable to support their military strategy.¹⁴² Even with the reduction in their transportation capability, the communists merely resynchronized their operation with what was available.

The post-war statements about the success of Strangle achieving its objective of denying the enemy the capability to launch a major offensive were true; the enemy did not launch a major offensive during the execution of Strangle.¹⁴³ However, why discontinue a "successful" campaign if Strangle was achieving its objective? The political and military objectives had not changed during Strangle. It would seem it was discontinued because the FEAF planners finally realized that destruction of the transportation system was not contributing sufficiently to the outcome of forcing the communists to agree to an armistice. Furthermore, as the Destruction-Outcome Linkage Model suggests, the attack of a single target system is unlikely to produce a fourth-order effect *by itself*.

Summary

In this chapter, we have examined the use of airpower in its first application in a limited war -- the targeting of transportation in Operation Strangle during the Korean War. Prepared to fight the worst case scenario of a nuclear war with the Soviets, the Air Force attempted to target North Korea using the familiar Douhetan/ACTS paradigm -- destroy enough of the "right" things and they will eventually quit. The restrictions on

targeting, permitting a sanctuary, the factors of technology, force structure, and lack of centralized control all served to limit airpower's capability to inflict first-order effects. The FEAF planners, however, failed to fully recognize these limitations and how these limitations would impede the linkage of destruction to outcome. Only after almost a year of effort did planners realize the linkage had not made.

Despite what now seems an obvious lack of understanding the destruction-outcome linkage, after the Korean War, General Weyland presented a graphical representation of what is essentially a destruction-outcome linkage, shown in Figure 2.¹⁴⁴ Much simpler than the Destruction-Outcome Linkage Model, it reflects the Douhetan/ACTS destruction-outcome linkage. The linkage is simply that the destruction of targets results in the political objective. This is the very problem identified by Colonel Cain in the epigraph.

After the Korean War, General Weyland observed that “what was remembered from World War II was not written down, or if written down was not disseminated, or if disseminated was not read or understood.”¹⁴⁵ With some influential leaders in the Air Force publicly discarding the Korean experience as an “aberration” rather than a true test for airpower, there was even less of a chance that the Korean war lessons would be disseminated, read or understood. Ironically, less than 12 years after the Korean War, the U.S. found itself involved in another war involving a small south-east Asian nation backed up by other Communist nations and with significant political restrictions imposed on targeting. In the next chapter, we will examine how the Air Force targeted transportation in Rolling Thunder during the Vietnam War.

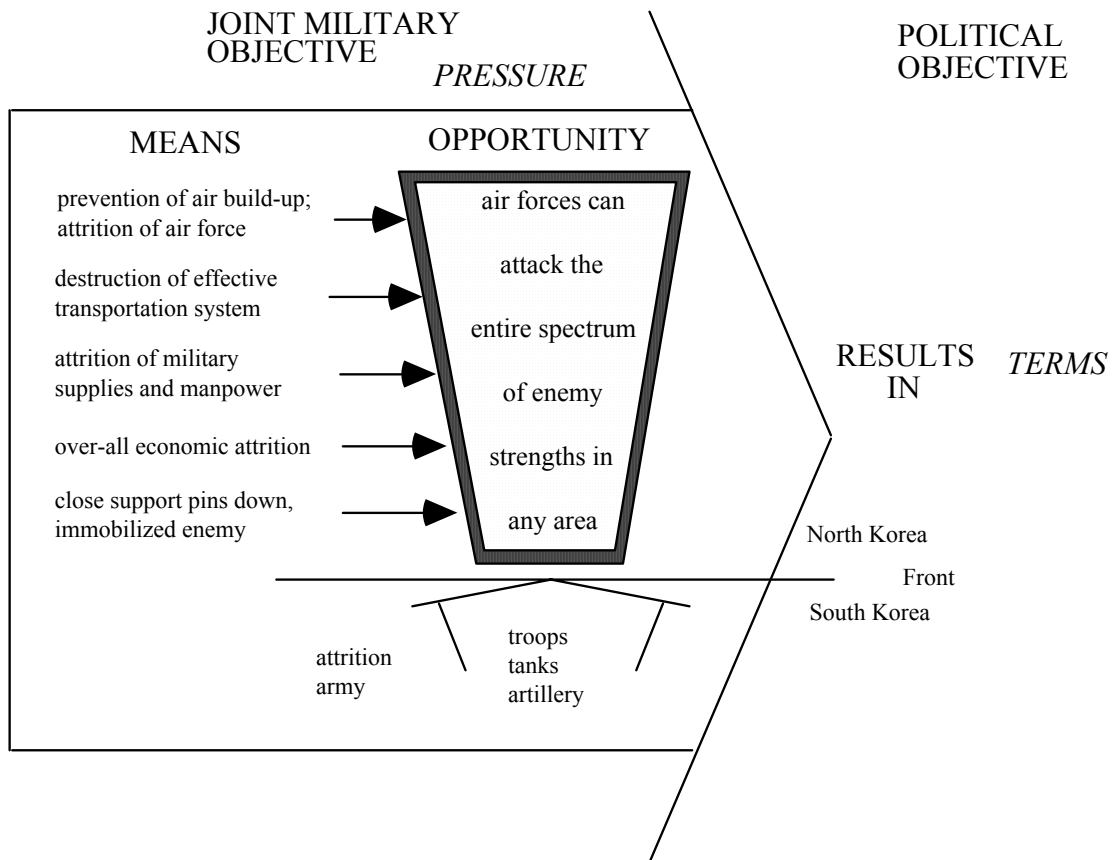


FIGURE 2 (Source: Weyland, "The Air Campaign in Korea," 24)

Notes

⁹² Colonel William J. Cain Jr., "An Air Force Concept for the Attack," Lecture to Air War College on 18 February 1955 at Maxwell AFB, AL.

⁹³ After the war, General O.P. Weyland stated it was unfortunate that the term "strangle" was used to identify the campaign because it did not convey the objective of the campaign. General Otto P. Weyland, "The Air Campaign in Korea," Air University Quarterly Review VI, no. 3 (Fall 1953), 21.

⁹⁴ Bernard Brodie, "The Heritage of Douhet," Air University Quarterly Review VI, no. 2 (Summer 1953), 64.

⁹⁵ Futrell, Ideas, Vol. I, 240.

⁹⁶ *Ibid.*, 222. By 1950, the total defense budget had reached \$13 billion of which the Air Force share was \$4.433 billion.

97 The deficit spending of World War II triggered a strong fear of economy-damaging inflation. Some leaders believed a strong economy was just as important in combating the Soviets as a strong military. See Russell F. Weigley, The American Way of War (Bloomington, IN: Indiana University Press, 1973), 400.

98 This is not to say this was necessarily wrong. The most ominous threat to national security was a nuclear-armed Soviet Union. With the collapse of the Soviet Union considered irreversible by late-1991, the U.S. and its allies had won the Cold War. The nuclear holocaust did not occur and this was due in very large measure to the convincing nuclear deterrent force developed by the Air Force as well as the Navy and Army. However, the wrong assumption was that the forces developed to deter nuclear war would be sufficient to deal with lesser types of war. As Sir John Slessor put it, "The dog we keep to deal with the cat will be able to deal with the kittens." Quoted in Bernard Brodie, Strategy in the Missile Age (Princeton, NJ: Princeton University Press, 1965), 331.

99 "The Starving Revolution: 1947-1950," Air Force and Space Digest, September 1967, 78.

100 Futrell, Ideas, Vol. I, 222.

101 Colonel William H. Wise, "Future of the Tactical Air Force," Air University Quarterly Review II, no. 4 (Spring 1949), 35.

102 Futrell, Ideas, Vol. I, 239. By the Mid-1980s this attitude will have changed considerably.

103 Eventually, pinpoint accuracy would be necessary to achieve hard-target kill capability necessary to support a counterforce targeting strategy.

104 Futrell, Ideas, Vol. I, 237-240.

105 Ibid., 239.

106 Korea had been essentially "written off" as having any strategic significance by both the military and political leaders. See Matthew B. Ridgway, The Korean War (New York: Da Capo Press, 1967), 10. For a good explanation of how and why the U.S. got caught off guard and can be found in Peter C. Unsinger, "Three Intelligence Blunders in Korea," International Journal of Intelligence and Counterintelligence 3, no. 4 (Winter 1989).

107 The command and control arrangements for CAS had to be quickly improvised in the opening days of the war. Radios transported on jeeps by the Tactical Air Control Parties were unreliable and unable to withstand the battering incurred by driving over harsh terrain. See Robert F. Futrell, The United States Air Force in Korea (Washington, DC: Office of Air Force History, 1983), 77-83.

108 As Russell Weigley puts it the "Air Force support operations were handicapped because the newly independent Air Force had neglected tactical air support while concentrating on readiness to deliver the atomic bomb, and Fifth Air Force and Eighth Army in Japan in particular had not carried out exercises in air-ground coordination." See Weigley, 384.

109 Futrell, Korea, 2.

110 HQ Far East Air Forces, "Weekly Intelligence Roundup No. 11," 12-18 November 1950, 15-16, AFHRA File No. K168.041-1 v.16. This information is from a summary of GHQ FEC Translator and

Interpreter Service Research Report No. 19, "Effectiveness of the United Nations Tactical Air Effort", 6 November 1950.

111 Ibid.

112 Department of the Air Force Directorate of Intelligence, "A Report on the Effectiveness of the Interdiction Program Against North Korea," 13 September 1950, 4-5, AFHRA File No. K142.04-28. B/G Banfill went on to state that "The extent to which manpower is employed in Korea in the execution of tasks and the movement of supplies and equipment must be observed in order to be believed."

113 Far East Air Forces Air Targets Research and Analysis Target Study, "Transportation Interdiction Plan," 2 September 1950, 3.

114 Assistant Chief of the Air Staff for Intelligence, "Evaluation of Transportation as an Air Target: A Summary of European Experience," 1.

115 General Douglas MacArthur had martyred himself over the issue of fighting to maintain a static line. For MacArthur there was "no substitute for victory." In President Truman's judgment, it was a matter of preventing World War III. The Truman/MacArthur controversy combined with the Cuban Missile Crisis would spawn a number of intellectual theorists who devised systems or methods to ensure the political leadership maintained complete control over military operations that might escalate into nuclear confrontation with the Soviets.

116 The Air Force had come to the correct conclusion that since there was no way to strike at the source of the Communist supplies, there was little hope a strategic bombing campaign could have any decisive impact. See Futrell, Korea, 195.

117 Ibid., 440-441. According to Futrell, General Frank Everest, Commander of the Fifth Air Force, reportedly said his planners believed that the attacks "would so weaken the enemy that he could easily be routed by an Eighth Army ground offensive or the would be forced voluntarily to withdraw his troops to the Manchurian border in order to shorten his supply lines."

118 Ibid., 324.

119 There would be periodic battles to contest pieces of ground around the line of defense, but there was no large-scale offensive action by either side.

120 Futrell, Korea, 433.

121 Ibid., 439.

122 Ibid.

123 Ibid.

124 Ibid., 440.

125 Colonel R.L. Randolph, and Lieutenant Colonel B.I. Mayo, "The Application of FEAF Effort in Korea, 1952," 12 April 1952, 2, AFHRA File No. K720.01; Weyland, "The Air Campaign in Korea," 21.

126 Randolph and Mayo, 2.

127 Futrell, Korea 440.

128 The Navy analysis concluded, in December, 1951, that “It is probably impossible to achieve complete interdiction of a country only partially industrialized [and] possessing mass manpower except by physical occupation.” Richard P. Hallion, The Naval Air War in Korea, (Baltimore, MD: The Nautical & Aviation Publishing Company of America, 1986), 96.

129 Randolph and Mayo, 4.

130 Ibid., 4; Hallion, 96-103.

131 Futrell, Korea, 451-453.

132 Ibid., 453.

133 Randolph and Mayo, 3.

134 Ibid., 5.

135 Ibid., 6.

136 Mark Clodfelter defines “negative objectives” as attainable only by limiting the application of military power. A “positive” objective is one attainable by applying military power. See Mark Clodfelter, The Limits of Air Power: The American Bombing of North Vietnam (New York: The Free Press, 1989), xi.

137 Clodfelter, 13.

138 Futrell, Korea, 391.

139 The Navy, as well as the Army, took strong exception to the Air Force’s view of the decisiveness of airpower. See Futrell, Ideas, Vol. I, 406-408. The internecine struggle over the super-carrier versus the B-36 and the subsequent “Revolt of the Admirals” was not conducive to friendly relations between the Air Force and Navy.

140 “Minutes of the FEAF Formal Target Committee Meeting,” 25 June 1953, 3, AFHRA File No. K720.151A. At this meeting, there was discussion of including a Navy officer in meeting. The Commander of the Fifth Air Force made the suggestion. He thought it would be a good idea since the Navy had agreed to coordinate with the 5th AF on joint target selection. The Deputy for Operations for FEAF thought the inclusion of a Navy officer would effectively make the committee a FEC agency rather than one “responsible to the Commander General, FEAF.” In the 25 July meeting of the FEAF Formal Target Committee, the last such meeting of the group, it was decided that the 5AF commander would invite a navy representative from the Joint Operations Center.

141 Randolph and Mayo, 3.

142 The attacks on the transportation network reduced throughput to five percent of its prewar capacity, but this was still enough to support the Communists military strategy. See Clodfelter, 25.

¹⁴³ It is open to speculation whether the communists would even attempt another major offensive given their lack of airpower. The two previous communist attempts to overrun the peninsula had failed, primarily because of allied airpower's effectiveness. The UN forces were showing self-restraint in stopping at the 38th parallel. Somewhere in the communist calculations about their grand strategy must have been a consideration of the UN response should the communists launch yet another offensive. They must have considered the risk of what an attack would have had on that self-imposed restraint. Considering all the factors, it seems unlikely that the communists would have launched another offensive even if their transportation system had been largely undamaged.

¹⁴⁴ Weyland, "The Air Campaign in Korea," 24.

¹⁴⁵ MacIsaac, 643.

Chapter Five

Vietnam: Rolling Thunder

“The first, the supreme, the most far-reaching act of judgment that the statesman and the commander have to make is to establish...the kind of war on which they are embarking; neither mistaking it for, nor trying to turn it into, something that is alien to its nature. This is the first of all strategic questions and the most comprehensive.”¹⁴⁶

- Carl von Clausewitz
On War

“I think that when this is all sorted out down the road, [history will show our biggest mistake in Vietnam to have been] gradualism - the very tight restrictions on targeting, the idea of inching up the peninsula and they'll get the message. They didn't; they just tightened their air defenses, got more fighters and AAA and SAMs; while we're coming a little bit closer to the point where it got so damn expensive.”¹⁴⁷

- General George S. Brown

During the Rolling Thunder campaign, it was doubtful whether the statesman and the commander mutually established the “kind of war” on which they embarked. The political leaders decided to keep military operations under the tightest possible control right down to selecting individual targets and types of ordnance in a program of “gradualism.”¹⁴⁸ Military leaders repeatedly sought political approval to fight a decisive military campaign aimed at defeating the North Vietnamese. The political leaders’ inability to understand military theory and capability, and the military leaders’ inability to convince the political leaders of the futility of gradualism created a significant disconnect between destruction and desired outcome.

In this chapter, we will look at the targeting of transportation during Rolling Thunder. First, we will examine the developments that influenced airpower in the years between Korea and Vietnam. A significant portion of the discussion will involve the political context, especially the rationale for the tight control of military power. The

unprecedented degree of micromanagement at the highest levels of government made a profound impact on the destruction-outcome linkage. This will be followed by discussion of the Rolling Thunder campaign. Finally, we analyze the attack of transportation during Rolling Thunder using the Destruction-Outcome Linkage Model.

Interwar Development of Airpower

After the Korean War, the Air Force continued to focus on building nuclear force structure. Just as in the post-World War II period, the Air Force emphasized the doctrine, training, equipment, and force structure designed to deter, and if necessary, fight a nuclear war. Although the Air Force did not completely ignore the Korean War model of a limited war with political limitations, many military leaders saw it as an unlikely type of war.¹⁴⁹ Even during the Korean war, General Weyland warned of learning the wrong types of lessons, especially any notion that the war had shown strategic bombing was not necessary.¹⁵⁰

Reinforcing the Air Force's nuclear focus was the political desire to keep defense spending down. The National Security Council (NSC) issued NSC-162 in May 1953, which called for greater reliance on strategic airpower to contain communism.¹⁵¹ In his 25 January 1954 address to the Council on Foreign Relations in New York, Secretary of State John Foster Dulles outlined the Eisenhower administration's strategy of "Massive Retaliation."¹⁵² Part of the rationale for this strategy involved acquiring "a maximum deterrent at a bearable cost."¹⁵³ The technology of strategic and tactical nuclear weapons delivered by airpower assets helped achieve this strategy.¹⁵⁴ The beneficiary of this strategy was the Air Force as Congress appropriated more resources to strategic nuclear forces.¹⁵⁵

However, there was a growing uneasiness in the intellectual community about the reliance on strategic nuclear forces.¹⁵⁶ They began to debate the idea of "limited war" and the type of military force structure needed to fight one.¹⁵⁷ The essence of "limited war" theory was to limit the means and ends of a conflict to avoid World War III.¹⁵⁸

The most critical assumption of the theory was that political authorities could *very precisely control* the application of military force.¹⁵⁹

The Air Force addressed the concept of limited war and its role in such a conflict. For example, the Composite Air Strike Force, a collection of fighter, bomber, and reconnaissance squadrons that could be deployed quickly, was seen as a deterrent to limited war.¹⁶⁰ Yet, in the late 1950s, the actual role of the Air Force in a limited war seemed unclear. Was the role of the Air Force in a limited war to achieve independent objectives or support the ground forces?¹⁶¹ There was a sense of the difficulty involved with fighting a limited war.¹⁶² Ultimately, the Air Force and the military failed to adequately express a concept for fighting a limited war. This left the task to the “defense intellectuals.”¹⁶³

As the Kennedy administration replaced the Eisenhower administration, the strategy of “flexible response” replaced the strategy of massive retaliation.¹⁶⁴ This strategy called for military capability to respond at any level of conflict. The first task required to implement the strategy was to enhance the conventional force structure.¹⁶⁵ Almost immediately, Kennedy’s Secretary of Defense, Robert S. McNamara, implemented changes designed to increase the conventional forces, including expansion of the tactical air forces.¹⁶⁶ This change in emphasis could not take place overnight. It would be many years before any effects would be realized within the Air Force.¹⁶⁷

As President Johnson was about to commit the U.S. to a war in Vietnam, the Air Force was primarily a force designed to fight a nuclear war. Fighting a nuclear war dominated the thinking within the Air Force and drove the force structure including the development of missile and space technology.¹⁶⁸ The Air Force measured its combat effectiveness based on its ability to destroy the capability and will of the enemy just as the ACTS had developed the concept in the 1930s. The perception that the enemy’s will could be broken by destroying enough of the right “things” was still very much the *lingua franca* of airpower strategists -- conventional or nuclear. The Air Force had not

yet fielded the technology lacking in the Korea War, such as the ability to accurately deliver conventional munitions at night and in the weather.¹⁶⁹ Furthermore, the Air Force was about to be used in a new, untested application of military power very much different from the type for which it had been preparing. With its targeting philosophy still connected to the Douhetan/ACTS theory of a relentless attack on the will and capability of the enemy, the Air Force found itself unable to pursue the preferred targeting strategy due to political restrictions.

Development of the Rolling Thunder Course of Action

The Rolling Thunder campaign was preceded by a deliberative process of political decision-making by President Johnson and his advisors. By 1964, the insurgency in South Vietnam had been a nagging problem for U.S. leaders for over 10 years. The Kennedy administration had gradually escalated the U.S. commitment, but this did not stem the insurgency. President Johnson had to face the difficult task of determining how to deal with the situation he inherited from the Kennedy administration. President Johnson came to the conclusion that failure to stand up to communism in South Vietnam was tantamount to inviting the onset of World War III.¹⁷⁰ Believing that the prestige and credibility of the U.S. were at stake, President Johnson decided to show U.S. resolve against communism by preserving an independent, non-communist government in Vietnam.¹⁷¹ Despite the effort to stabilize the government with a variety of assistance programs, South Vietnam was on the verge of collapse by late-1964.¹⁷²

In November 1964, an NSC interagency working group, chaired by William Bundy, formulated strategies to guide the use of military power against North Vietnam.¹⁷³ The group constructed three possible courses of action in South Vietnam: (A) Do nothing - Continue present policy of reprisals, (B) Sharp Knock - Continuation of present policies plus “progressively heavy pressures against North Vietnam” that would continue without interruption until North Vietnam agreed to stop support of the

insurgency in South Vietnam and (C) Graduated Response - Apply gradually escalating military pressure against North Vietnam with occasional pauses for negotiation.¹⁷⁴

The NSC, based on the working group's analysis of the options, selected Option C as the most prudent course of action. They felt this option carried the least risk of escalation while sending a clear "signal" to the leaders of North Vietnam.¹⁷⁵ The JCS preferred Option B.¹⁷⁶ The JCS did not believe Option C would persuade the North Vietnamese. They felt that if the President decided to use military power against North Vietnam, it should not be done in the half-measures of Option C. Despite JCS protestations on the military ineffectiveness of Option C, the NSC took the position that bombing North Vietnam in a controlled, precise pattern would show the necessary resolve to persuade Hanoi to agree to quit supporting the insurgency in South Vietnam. The NSC had arrived at a destruction-outcome linkage consisting of little more than the idea that by destroying a very limited number of "things" the desired outcome would be achieved. Furthermore, the "things" to be destroyed would be tightly controlled and have little to do with a coherent military strategy. Instead, the targets would be selected on the basis of undefined, vague notions of "sending messages" and showing "resolve."

The NSC presented the President with their recommendation and he chose a modified version of Option C. The modified version consisted of two phases. The first phase was a 30-day program of attacks on the infiltration routes in Laos. During this time, the U.S. would work to stabilize the political situation in South Vietnam. The second phase was the "graduated response" program against North Vietnam as described in Option C.¹⁷⁷ The President approved Phase I on 1 December 1964.¹⁷⁸ In the face of a rapidly deteriorating situation in South Vietnam, the President approved the start of Phase II, known as Rolling Thunder, on 13 February 1965. The first mission took place on 2 March.¹⁷⁹

Execution of Rolling Thunder

The execution of Rolling Thunder does not lend itself to easy description. It was not a comprehensive air campaign designed to achieve specific military objectives. Rather it was a closely controlled, micromanaged, week-by-week program of attacking “things.” Military planners had the difficult task of linking destruction of targets to desired outcome without being in control of the targeting or having a clear understanding of the outcome desired.¹⁸⁰ If the key to targeting is, as the Destruction-Outcome Linkage Model suggests, being able to inflict sufficient first-order destruction on targets systems to produce second-, third-, and fourth-order effects, then this approach was not likely to succeed. The “gradualism” merely allowed the enemy to adapt to the bombing.

Political leaders tightly controlled the targeting throughout Rolling Thunder. All targets had to be cleared by Secretary of Defense, Department of State, and the White House. President Johnson made his targeting decisions during the “Tuesday White House Luncheons” with a small group of his political advisors. No senior military officer was present at these meetings until October 1967, when the Chairman of the JCS, General Earle Wheeler, was finally invited to attend.¹⁸¹ It was in this context that the Air Force had to conduct operations in Rolling Thunder.

By the summer of 1965, North Vietnamese leaders had not yet been “persuaded” by the bombing to give up their support of the insurgency.¹⁸² At this point, the focus of the Rolling Thunder transitioned from “sending a message” to the attack of transportation. The objective became reduction of infiltration into South Vietnam. Even before the President selected this objective, the military and political leaders felt airpower could not completely shut down the North Vietnamese transportation system. However, political leaders preferred this strategy because of its decreased risk of widening the war. Military leaders were not satisfied with a program of attacks against transportation.¹⁸³ The JCS and CINCPAC voiced their dissatisfaction with the

gradualistic approach and the numerous targeting restrictions throughout Rolling Thunder.

North Vietnam's transportation network was neither complex nor modern. A series of roads and trails ran from Chinese border to Hanoi. These roads were poor quality and capacity was dependent on the time of year.¹⁸⁴ The road system running from North Vietnam through Laos and Cambodia into South Vietnam known as the Ho Chi Minh Trail was not much more than paths through the jungle in many places.¹⁸⁵ The rail system was centered around Hanoi with single-track lines running northeast and northwest to China, to Haiphong and to the southern part of the country.¹⁸⁶ A system of waterways supplemented the road and rail network. The port at Haiphong was used for importing materiel via sea transportation. The combined import capability of the transportation system was estimated at 17,200 tons/day.¹⁸⁷

From August 1965 until March 1968, the number of sorties flown against transportation targets was gradually increased on a month-by-month basis.¹⁸⁸ The President slowly relaxed targeting restrictions with time, but the sensitive areas of Hanoi, Haiphong and the Chinese buffer zone remained under close political control. When it ended, over 90% of the Rolling Thunder attack sorties had been flown against transportation targets.¹⁸⁹ The following statistics on the destruction of North Vietnam's transportation system were compiled:¹⁹⁰

- 5,317 pieces of rolling stock damaged or destroyed
- 88 locomotives damaged or destroyed
- 2,384 rail line cuts reported
- All major marshalling yards and repair shops were eventually hit
- 6,233 bridges damaged or destroyed
- 269 ferries damaged or destroyed
- over 38,000 waterborne logistic craft were damaged or destroyed

- 11,744 vehicles damaged or destroyed
- 16,065 road cuts reported

Even with this level of destruction, North Vietnam's transportation system functioned well enough to meet the requirements of their military strategy. They successfully compensated for the second- and third-order effects on their transportation system with work-arounds and changes in their military strategy.

The failure to achieve the desired outcome was apparent by mid-1966. In August of 1966, a study group of top U.S. scientists at the Institute for Defense Analyses produced a report that became known as the Jason Summer Study. Their conclusion was that, "The alternative options that the NVN transportation network provides and the level of aid the USSR and China seem prepared to provide...make it quite unlikely that Hanoi's capability to function as a logistic funnel would be seriously impaired."¹⁹¹ By the end of 1966, a RAND study concluded that the attacks on the infiltration routes had failed to produce any meaningful results. It stated that, "As long as the present constraints on objectives and operations remain...it becomes increasingly doubtful that the advantage of continuation or intensification of the attacks outweigh the net gains from cessation or, at least, drastic and demonstrative de-escalation."¹⁹²

Both studies indicate that the first-order effects of destroying the pieces of the transportation system were not sufficient. Bombing produced the second-order effect of reduced capacity, but the North Vietnamese compensated for it. Even if capacity was reduced enough to cause a third-order effect, the North Vietnamese and Viet Cong were free to alter their military strategy by choosing when to engage in combats based on their transportation situation.

In late-1966, McNamara had become disillusioned with the results achieved in Rolling Thunder.¹⁹³ Mounting evidence pointed to a failure in achieving the goals set for the attack of the transportation system. The insurgency in South Vietnam had grown, not declined as hoped. Enemy forces, mostly in the form of NVA troops, increased by

40,000.¹⁹⁴ This occurred despite the amount of destruction applied to the transportation system.¹⁹⁵ It did not completely surprise the JCS, as they had predicted this failure over a year earlier.¹⁹⁶ Admiral Sharp, CINCPAC, characterized the sentiment of military leaders about what caused the failure with his conclusion that, "...in 1966 our Rolling Thunder campaign did not apply adequate and steady pressure against the enemy. Imposed restrictions have resulted in inefficient use of airpower."¹⁹⁷

As the war entered 1967, the intensity and scope of Rolling Thunder increased in an effort to inflict more costs to the North Vietnamese government in the hope of reaching the, thus far, elusive point that would persuade them to cease the war effort. The escalation in the air war against transportation began in April when the political authorities released the Hanoi railroad repair facilities for attack.¹⁹⁸ In July, additional targets in the Hanoi and Haiphong areas were released including the Hanoi railroad and road bridge on the Red River, bridges in the Haiphong area, and key highway targets within the Communist China buffer zone.¹⁹⁹ From May to September, the Air Force flew 3100 sorties against rail bridges, approaches, line segments, rolling stock, sidings, and marshalling yards as well as portions of the highway system.²⁰⁰ However, on 23 August, the targets around Hanoi were placed off limits again.²⁰¹ By the end of 1967, intelligence sources estimated another 35,000 to 56,000 troops had infiltrated into South Vietnam.²⁰²

Late in 1967, the Institute for Defense Analyses completed another study. They concluded that they, "...could not devise an air campaign that would reduce the amount of men and goods flowing south."²⁰³ In trying to explain why the level of effort against the transportation system was not working, Admiral U.S.G. Sharp observed that, "Through external assistance, the enemy has been able to replace or rehabilitate many of the items damaged or destroyed, and transport inventories are roughly at the same level they were at the beginning of the year."²⁰⁴ Analysts agreed that airpower had significantly reduced

the capacity of the transportation system, but it was not enough of a reduction to stop the infiltration.

As the political decision-makers grappled with the issue of what to bomb next, the North Vietnamese and Viet Cong launched the Tet Offensive in January 1968. Although the Tet Offensive was a military disaster for the enemy, the American public *perceived* it as a U.S. military defeat. Many people did not understand how the enemy conducted such an extensive offensive after the public proclamations of political and military leaders had painted a picture of success in defeating the communist insurgency.²⁰⁵ The repercussions from Tet led President Johnson, on 31 March 1968, to announce the de-escalation of bombing against North Vietnam. On 31 October 1968, Rolling Thunder ended with the President's announcement to cease bombing of North Vietnam.²⁰⁶

Analysis

The execution of Rolling Thunder stands as an example of how ineffective airpower can be when no clear and convincing linkage between destruction and outcome exists. The only linkage one could infer was that destruction, no matter how incoherently applied or what type of target, would eventually achieve the desired outcome. The concept of Rolling Thunder called for precisely controlled application of airpower to "signal" the U.S. resolve and intent to the leaders in Hanoi. Civilian national security advisors were convinced that airpower could be used to create the image in the enemy's mind of a gradually escalating pattern of destruction. North Vietnamese leaders, the advisors believed, would recognize that the pattern of destruction threatened the existence of North Vietnam unless their support of the insurgency in the south ceased.²⁰⁷ Whether the U.S. could send such a "signal" with a blunt instrument of war such as airpower received little critical evaluation.²⁰⁸ This gamesmanship was applied with little regard for what happened if the North Vietnamese did not play the game, or believed that the U.S. was bluffing.²⁰⁹

Military leaders, especially those in the Air Force, constantly advocated a more conventional application of military power. This meant elimination of most targeting restrictions,²¹⁰ removal of sanctuaries in North Vietnam, and authority for the theater commander to conduct a comprehensive bombing campaign largely free of micromanagement from Washington.²¹¹ The JCS-proposed 94-target (later expanded to 240) list bore striking resemblance to the types of targets hit in Nazi Germany -- oil, electricity, industry, and transportation. However, just as the political advisors failed to link destruction to outcome in a coherent fashion, the JCS also failed to make the linkage other than to argue that destruction itself would be of such devastating cost the North Vietnamese would realize it made no sense to continue the fight.

As an example, consider the case of striking Petroleum, Oil, and Lubricants (POL) targets in North Vietnam. The JCS pressed McNamara for permission to strike POL targets because it would reduce North Vietnam's transportation capability. Based on the persuasive arguments of the Air Force and Navy, McNamara permitted air strikes against POL targets. The attacks on POL caused the North Vietnamese to react to the second-order effect by finding work-arounds such as dispersing storage sites, importing fuel in barrels rather than bulk, and transferring movement of materiel to modes not dependent on oil. These work-arounds were effective enough to prevent the attacks on POL from having any significant effect on infiltration. McNamara was not happy with the failure of the attacks to have the desired effect and he reminded the Air Force and Navy about their "glaring discrepancy" between prediction and result.²¹² The point of this example is that there was faulty analysis concerning how North Vietnam might react to such an attack. The linkage between destruction of the oil storage sites to achievement of the desired reduction of infiltration was incomplete.

To be fair, the JCS never got the chance to execute their desired course of action in Rolling Thunder. From the start, the JCS preferred the "sharp knock." Many people argued after the war that if the U.S. had conducted a Linebacker II-type bombing

campaign in 1965, then the outcome could have been quickly achieved. It is certainly possible that if such a campaign *could* have been conducted in 1965, then it *might* have been successful. Such a campaign, however, was politically impossible in 1965.

In Rolling Thunder, just like Strangle in Korea, the focus of effort was against a single target set -- transportation. Like the North Koreans, the North Vietnamese compensated for the first-order destruction in many ways and used many of the same work-arounds as the North Koreans.²¹³ Like the North Koreans, the North Vietnamese took advantage of the Air Force's lack of ability to hit pinpoint targets at night or during bad weather. Like the North Koreans, the North Vietnamese resynchronized their operations with available transportation and shifted their military strategy from decisive victory to protracted conflict.²¹⁴ Finally, like the North Koreans, the North Vietnamese were able to react to the destruction of their transportation system in a manner that ensured the U.S. did not achieve a fourth-order effect. The weather, terrain, lack of an all-weather, around-the-clock attack capability, and a military strategy that allowed the enemy to control the tempo of fighting all contributed to the failure of Rolling Thunder. However, the lesson of Rolling Thunder is that, no matter how capable airpower might be, *excessive restraints on targeting may deny the ability to make the destruction-outcome linkage.*

Summary

In this chapter, we have examined the role of airpower in Rolling Thunder against the North Vietnamese transportation system. The Air Force chose to minimize the Korean War experience and focus on the development of strategic nuclear forces. Air Force strategists discussed ideas about limited war, but it was not clear what the Air Force's role was in such actions. Civilian intellectuals and policy makers filled the void with their concepts of limited war and the use of force to "signal" and show resolve. Translating academic arguments about "keeping the hostage alive" and the coercive effectiveness of the *threat* of graduated military pressure into reality proved incredibly

difficult. In the end, it did not work because the translation did not clearly and convincingly link destruction to outcome. Furthermore, the strict political micromanagement ensured the linkage could not be made because the amount of destruction required was politically unacceptable. Eventually, in 1967, Rolling Thunder reached a tempo and level of effort that *might* have been effective in 1965. Unfortunately, it was too late because the enemy had adjusted and adapted to the gradually escalated attacks.

In the next chapter, we will examine the Persian Gulf War, the most recent conflict in which airpower was used against transportation. Over 20 years elapsed between the end of Rolling Thunder and the start of Desert Storm. The bitter experience of Rolling Thunder motivated Air Force leaders to make changes in force structure, doctrine, and training over those 20-plus years. These changes would profoundly affect airpower's ability to link destruction to outcome.

Notes

¹⁴⁶ Clausewitz, 88-89.

¹⁴⁷ United States Air Force Oral History Program, "Interview of General George S. Brown," 19-20 October 1970, 122, AFHRA File No. K239.0512-365.

¹⁴⁸ President Johnson was reported to have said that "They can't even bomb an outhouse without my permission." See Stanley Karnow, Vietnam: A History (New York: Penguin Books, 1991), 430.

¹⁴⁹ Futrell, Ideas, Vol. I, 419.

¹⁵⁰ Memo from Major General O.P. Weyland to General Hoyt S. Vandenberg, Hq Far East Air Forces, 12 October 1950, 7, AFHRA File No. 168.7104-63. At the time, Weyland was the Vice Commander for Operations of FEAF. He also mentioned other "erroneous lessons" of Korean war:

- That air superiority may be practically assumed
- That practically unlimited air will always be available for close support of ground forces
- That practically unlimited air lift can normally be expected

¹⁵¹ Weigley, 401.

¹⁵² This speech was the catalyst for an intense debate amongst academic intellectuals over the merits of a strategy that appeared to mean nuclear annihilation of the U.S. if deterrence failed.

153 Weigley, 404.

154 Amos A. Jordan, William J. Taylor Jr., and Lawrence J. Korb, American National Security: Policy and Process, Third ed. (Baltimore, MD: John Hopkins University Press, 1989), 66.

155 By fiscal 1955, the Air Force received \$11.6 billion, \$7.6 billion for the Army, and the Navy got \$9.7 billion. Futrell, Ideas, Vol. I, 427.

156 Walter Millis, Harvey C. Mansfield, and Harold Stein, Arms and the State (New York: The Twentieth Century Fund, 1958), 200-201. The authors point out how “increasingly the military policy of the nation was to be framed around the dreadful, and in most situations inapplicable, Air Force concept of ‘strategic’ bombing with mass-destruction weapons.” Since Soviets were to soon develop nuclear weapons this seemed “a valid, indeed a necessary, decision. Perhaps none other could have been taken at that time. It is still questionable whether it was a valid decision in early 1947. For the crises which lay immediately ahead, the strategic Air Force was to prove a nearly useless military instrument...it has not in itself proved a practicable instrument of positive policy.”

157 For a list of the various limited war theorists, see Robert E. Osgood, Limited War Revisited (Boulder, CO: Westview Press, 1979), 110.

158 *Ibid.*, 3.

159 *Ibid.*, 10-11.

160 Futrell, Ideas, Vol. I, 450.

161 Colonel Ephraim M. Hampton, “Symposium on Limited War,” Air War College, 14 March 1957, 5-6, AFHRA File No. K239.042957-1. The paper points out that “The Air Force...does not appear to be firm in its views as to exactly what its role [in limited war] should be...whether it would be one...of supporting and exploiting surface operations, or whether it would establish...conditions which would either be decisive in themselves and thus preclude surface operations, or which would establish conditions so favorable as to make successful exploitation of results by surface forces a foregone conclusion...If we believe that our role should be primarily one of supporting surface actions, then we should give greater consideration to the development of tactical type forces than we are presently doing.”

162 Hampton, 9. “Each area where a limited war could possibly occur will present different inherent theater capabilities, base structures and logistic situations. The geography, target systems, and status of indigenous forces will vary. Political situations will present a variety of problems”

163 Bernard Brodie made the point that the “defense intellectuals” were not held in high esteem by the military leadership. See Bernard Brodie, War and Politics, (New York: MacMillan Publishing Co., Inc., 1973), 466-473.

164 Michael Carver, “Conventional Warfare in the Nuclear Age,” Makers of Modern Strategy, ed. Peter Paret, (Princeton, NJ: Princeton University Press, 1986), 787.

165 Weigley, 445.

166 Amos A. Jordan, William J. Taylor Jr., and Lawrence J. Korb, 71.

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- 167 John Schlicht, The War in South Vietnam: The Years of the Offensive, 1965-1968 (Washington, DC: Office of Air Force History, 1988), 301.
- 168 Earl H. Tilford Jr., Setup: What the Air Force Did in Vietnam and Why (Maxwell AFB, AL: Air University Press, 1991), 19-40; Futrell, Ideas, Vol. I, 589-629.
- 169 General William W. Momyer, Air Power in Three Wars (Washington, DC: U.S. Government Printing Office, 1978), 177. Momyer points out that throughout Rolling Thunder the Air Force could not hit pinpoint targets in the weather.
- 170 Clodfelter, 42.
- 171 This position was officially taken in NSAM-288, issued in March 1964. Department of Defense Study, United States - Vietnam Relations, 1945-1967 (Washington, DC: US Government Printing Office, 1971) Vol. 3, IV.C.1.iii. (Hereafter referred to as "DoD Study")
- 172 DoD Study, Vol. 4, IV.C.3.10.
- 173 DoD Study, Vol. 4, IV.C.2 (c) viii.
- 174 DoD Study, Vol. 4, IV.C.2 (c) 18-37.
- 175 The pitfalls involved trying to "signal" intentions with military force are explained in Wallace J. Thies, When Governments Collide (Berkeley, CA: University of California Press, 1980), 376-396. Thies points out that "By far the two most important lessons that can be drawn from the Vietnamese case center on the nature of governmental interaction in situations involving the use of coercive pressures and the difficulties that government officials are likely to encounter when they seek to influence the choices of their counterparts in another government." Ibid., 376.
- 176 DoD Study, Vol. 4, IV.C.2 (c) 32-35. Furthermore, the JCS had recommended 94 targets be destroyed in 16 days. The "sharp knock" approach was designed to "paralyze the enemy's capability to move his equipment and people to the south, organize and equip his air defense, and to assemble the large numbers of people required for LOC, communications, and facilities repair." See Lieutenant Colonel Sam B. Barrett, "Corona Harvest: The Air Campaign Against North Vietnam," Maxwell AFB, AL, October 1969, 28-29, AFHRA File No. K239.032-37.
- 177 DoD Study, Vol. 4, IV.C.2 (c) x-xi.
- 178 DoD Study, Vol. 4, IV.C.2 (c) xi.
- 179 DoD Study, Vol. 4, IV.C.3 xii-xiii.
- 180 Just how unclear the objectives had become is illustrated by General Robert Dixon. When asked what our objectives were in the campaign against the North, he responded, "I think that's a political question. I don't want to answer it." Project Corona Harvest, "Interview with General Robert J. Dixon: Oral History Interview #385," 1-2 December 1970, 15, AFHRA File No. K239.0512-385. As early as June, 1964, the JCS was concerned over "a lack of definition of U.S. objectives" and that it was the JCS' "first obligation to define a militarily valid objective for Southeast Asia and then advocate a desirable military course of

action to achieve that objective.” The ideas about “signaling” and “sending messages” were already, at this early point, perceived by the JCS as counterproductive to the effective application of military power. See DoD Study, Vol. 3, IV.C.2. (a) 29.

181 Clodfelter, 85. One author noted that Wheeler was invited to the lunches because President Johnson thought McNamara had “gone soft.” See David Halberstam, “The Programming of Robert McNamara,” Harper's Magazine 242, no. 1449 (February 1971), 64.

182 DoD Study, Vol. 6, IV.C.7. (a) 4. The study noted that by the summer of 1965, “Hardly any of the targets most valued by Hanoi -- the ‘lucrative’ targets of the JCS master list -- had been hit. If the main purpose of Rolling Thunder was to impose strong pressure on Hanoi’s will, the ‘lucrative’ targets in the Hanoi/Haiphong area, not those in the barren southern Panhandle, were the ones to go after, and to hit hard.”

183 There are a series of JCS memos and messages from CINCPAC during Rolling Thunder that make it clear the preferred military strategy was to deliver an intensive, sustained air campaign against not only the transportation system but also oil, electricity, and other industrial targets in North Vietnam. By late 1966, the JCS rift with McNamara over targeting and restrictions was evident as the JCS took exception to McNamara’s recommendation for a bombing halt. See James L. Greenfield, ed., The Pentagon Papers (New York: Bantam Books, 1971), 553.

184 There were many roads leading into NVN from China, but there were six primary routes from China to Hanoi with a total capacity of 3144 tons/day in the dry season and 584 tons/day in the wet season. “Highway Campaign in NVN,” n.d (believed to be 4th quarter of 1967), 3, AFHRA File No. K712.041-10.

185 Attack of the Ho Chi Minh Trail outside of North Vietnam was not part of Rolling Thunder. It fell under the Barrel Roll and Steel Tiger operations. If a Rolling Thunder mission was unable to expend ordnance against its primary target in North Vietnam, it could be diverted to support Barrel Roll/Steel Tiger.

186 DoD Study, Vol. 6, IV.C.7 (a) 55. Admiral U.S.G. Sharp, former CINCPAC, thought Hanoi was the key to the transportation network in North Vietnam. “...if you could obliterate that part of transportation in and around Hanoi then you have got the country stopped.” Project Corona Harvest, “Interview with Admiral U.S. Grant Sharp - Oral History Interview #409,” 19 February 1971, 24, AFHRA File No. K239.0512-409.

187 DoD Study, Vol. 6, IV.C.7 (b) 11. It was estimated that the North Vietnamese needed to import 6,200 - 8,100 tons/day. Clodfelter, 134.

188 Rolling Thunder sorties totaled 33,000 in 1965 and 148,000 in 1966. See DoD Study, Vol. 6, IV.C.7 (a) 177-178.

189 Clodfelter, 134.

190 Barrett, 7.

191 Report by the Institute for Defense Analyses “The Effects of U.S. bombing on North Vietnam's Ability to Support Military Operations in South Vietnam: Retrospect and Prospect,” 29 August 1966. See Greenfield, 503.

192 Hq PACAF Directorate of Tactical Evaluation. CHECO Division, "Rolling Thunder: July 1965 - December 1966," 15 July 1967, 133-134, AFHRA File No. K717.0414-12

193 Memo from McNamara to President Johnson, "Actions Recommended for Vietnam," 14 October 1966. Greenfield, 550-551. McNamara believed the conclusions of the Jason Summer Study. He felt that destroying the railroad and closing Haiphong harbor would "hurt the people and increase costs but [would] not change the outlook. This follows because NVN has demonstrated excellent ability to improvise transportation, and because the primitive nature of their economy is such that Rolling Thunder can affect directly only a small fraction of the population." Furthermore, "Despite these efforts, it now appears that the North Vietnamese-Loatian road network will remain adequate to meet the requirements of the communist forces in South Vietnam."

194 Hq PACAF Directorate of Tactical Evaluation. CHECO Division, 124-125.

195 Cable from Admiral U.S. Grant Sharp to Chairman of the JCS, "Year-End Wrap-up Cable," 1 January 1968. James L. Greenfield, 613-614. During 1967, the cable reports 122,960 attack sorties in Rolling Thunder in Route Packs 1 through 5. and Laos. A total of 5261 motor vehicles, 2475 railroad rolling stock and 11425 watercraft were reported destroyed or damaged.

196 Clodfelter, 88. Clodfelter notes that, "The Joint Chiefs warned that the current air campaign could not completely eliminate adequate logistical support to the enemy. They blamed controls on both targeting and weight of effort, along with the small amounts of aid required by current Viet Cong and North Vietnamese operations, for Rolling Thunder's failure to affect the supply flow.

197 Colonel Roberts L. Underwood, "Air Interdiction in Southeast Asia: An Overview," Air War College Research Report, 1969, 55-57.

198 Ibid., 57-60.

199 Ibid., 57-60 and Colonel Douglas E. Whatley, "The Effectiveness of U.S. Airpower in the Air Campaign Over North Vietnam," Air War College Research Report, 1970, 21.

200 "Highway Campaign in NVN," 5.

201 Whatley, 21. The author noted that, "these strikes dealt heavy damage and destruction to railroad rolling stock and interdiction of the railroad lines...just when the full impact of the potency of our airpower could be exploited, all targets in the Hanoi area were again placed off limits on August 23."

202 Ibid., 22.

203 Clodfelter, 111-112.

204 Cablegram Admiral U.S. Grant Sharp, CINCPAC, to the Chairman of the JSC, 1 Jan 1968, "Year-End Wrap-Up Cable." Greenfield, 613-614.

205 Just one example of the mood after Tet was an editorial that stated "...the American people have not been given a realistic assessment of the situation in Vietnam...A strategy of the same is no longer tolerable." See "Needed: The Courage to Face the Truth," Newsweek 18 March 1968, 39.

²⁰⁶ Research and Analysis Division, SAFAA, Selected Statements on Vietnam by DoD and other Administration Officials, July 1 - December 31, 1968. Excerpts from 31 October, 1968, televised national address.

²⁰⁷ Some of this philosophy about gradually using force to demonstrate to the adversary that unless their behavior changes they risk much more destruction is contained in Thomas C. Schelling, Arms and Influence (New Haven: Yale University Press, 1966). Schelling uses the example of the dropping of the atomic bombs on Japan in World War II to argue that, “The effect of the bombs, and their purpose, were not mainly the military destruction they accomplished but the pain and shock and promise of more.” Ibid., 18.

²⁰⁸ The notable exception was George Ball. Ball made it clear he did not think the proposed use of airpower in Vietnam would be successful. See George W. Ball, “Top Secret: The Prophecy the President Rejected,” The Atlantic 230, no. 1 (July 1972), 37-49. (This is a reprint of Ball’s memo titled “How Valid are the Assumptions Underlying Our Vietnam Policies?”)

²⁰⁹ Stanley Hoffman, et al., “Vietnam Reappraised,” International Security 6, no. 1 (Summer 1981), 11.

²¹⁰ In the Destruction-Outcome Linkage Model, targets are selected on the basis of their criticality in the operation of the targeted system. In Rolling Thunder, targeting was not based on this criterion, but on McNamara’s three criteria for hitting or not hitting a target: 1) the value of the target, 2) risk of the U.S. pilot loss, and 3) risk of widening the war. See Clodfelter, 85.

²¹¹ All of these restrictions, and others not listed, were codified in the “rules of engagement.” These rules were considered so complicated that a common perception was that the back seat of the F-4 was for a lawyer who could help the pilot understand them. The “lawyer in the back seat of an F-4” reference seems to have been a common perception as it shows up regularly in personal interviews. For example, see General Brown Interview, 122; and Interview with General Robert J. Dixon, 15. A list of these restriction can be found in Hq PACAF Directorate of Tactical Evaluation. CHECO Division, 43-47.

²¹² DoD Study, Vol. 6, IV.C.7 (a) 144.

²¹³ North Vietnam mobilized approximately 300,000 to 600,000 workers to keep the transportation system operating. They built bypass roads around chokepoints and replaced knocked out bridges with fords, ferries or other structures. They shifted operations to nighttime and bad weather. Shuttling and transshipment practices were used. Construction material, equipment, and workers were prepositioned along key routes in order to effect quick repairs. See DoD Study, Vol. 6, IV.C.7 (a) 55-56.

²¹⁴ DoD Study, Vol. 6, IV.C.7 (a) 56.

Chapter Six

Desert Storm

“Anybody that does a campaign against transportation systems [had] better beware! It looks surprisingly easy. It is a tough nut to crack. [The Iraqis] were very ingenious and industrious in repairing them or bypassing them...I have never seen so many pontoon bridges. [When] the canals near Basra [were bombed], they just filled them in with dirt and drove across the dirt.”²¹⁵

- Lieutenant General Charles A. Horner

In the wake of the Vietnam War, there was a great deal of self-analysis on what went wrong on both the political and military sides. By the time of Desert Storm, officers with Vietnam experience filled the key leadership positions within the military. They were determined to apply force in a quick, decisive operation.²¹⁶ Political leaders would always be in control, but the President decided not to micromanage.²¹⁷ Instead, they would permit the military commander the latitude to conduct operations according to traditional military principles.²¹⁸ The common theme from both the political and military leaders was that any war with Iraq would not be “another Vietnam.”²¹⁹

This chapter examines the application of airpower in Desert Storm. In the previous three chapters, there was a clear campaign against the enemy’s transportation system that consumed most of the available attack sorties. Desert Storm differed from these campaigns because it was a comprehensive air campaign that targeted several different systems simultaneously. We will still use transportation as the vehicle to illustrate the discussion, but in the analysis we will also consider the effects of other targeting efforts. As in the past air campaigns, we first look at airpower development between the end of Vietnam and Desert Storm. In the two decades between these wars, there was an evolution that would provide unprecedented ability to inflict first-order destruction to target sets using conventional weapons. Also, during this period there was

a slow, but steady shift from the dominance of the strategic nuclear bombing mission towards more capable conventional forces. Next, we discuss the planning and execution of the air campaign against Iraq and its military forces in Desert Storm. Finally, we analyze the air campaign using the Destruction-Outcome Linkage Model.

Interwar Development of Airpower

In the 18 years between the end of Vietnam and the start of Desert Storm, there were a number of key developments in airpower. As in the other post-World War II interwar periods discussed, the Cold War context shaped these developments. Yet, unlike the period after Korea, there was a slow, but steady shift away from the dominance of nuclear forces toward an emphasis on conventional force structure, training, and equipment.²²⁰ Of concern to our analysis were those developments related to the capability of airpower to produce first-order effects and the doctrinal thinking about how that capability contributed to the desired outcome.

The Vietnam War revealed airpower's inability to produce sufficient first-order effects in certain target systems, especially the transportation system. This limited ability to produce first-order effects can be broken down into two components. First, there were the self-imposed political restraints. There have always been political restraints on war, but the fear of a small conflict mushrooming into World War III magnified and multiplied these restraints. Examples of restraints include placing certain parts of the adversary's territory off-limits to attack and highly restrictive rules of engagement. Restraints could result in a valuable part of the target system being made virtually invulnerable to air attack.²²¹ Second, technological capabilities of airpower limited the amount of first-order effects that could be inflicted. Airpower simply was not technologically capable enough to find, attack, and functionally or physically destroy the necessary numbers and types of targets. The North Vietnamese consistently overcame the first-order effects with second- and third-order reactions. Both of these limitations

were addressed during the period between Vietnam and Desert Storm in ways that would have a profound impact on the ability to produce first-order effects.

The impact of the self-imposed restraints on the outcome in Vietnam contributed directly to the development of the “No more Vietnams” syndrome in both the political and military circles.²²² After Vietnam, many military leaders severely criticized the excessive political restraints on military operations. The success of Linebacker II seemed to validate the military leaders’ arguments.²²³ Many argued that a Linebacker II-type operation was what was needed from the start and that if such an operation been conducted in 1965, then the same decisive results could have been achieved.²²⁴

These arguments were not ignored. Political leaders started to carefully consider the impact of political limitations on military operations, especially if those limitations might cause a military operation to degenerate into a long, indecisive war of attrition or result in needless U.S. casualties.²²⁵ A major milestone occurred in 1984, when Secretary of Defense Caspar Weinberger advocated a set of criteria to determine whether the U.S. should commit armed forces to a conflict.²²⁶ Clearly designed to avoid “another Vietnam,” Secretary Weinberger outlined six tests that the U.S. should apply to determine if use of force is warranted:²²⁷ 1) The conflict is deemed in the vital national interest, 2) There is a clear intention of winning, 3) Political and military objectives are clearly defined, 4) The relationship between forces and objectives must be continually evaluated, 5) The American public and Congress support the action, and 6) Commitment of U.S. forces is a last resort. The “Weinberger Doctrine” implied that political leaders should hold self-imposed restraints on first-order destruction to a minimum.

The technological limitations on producing first-effects were also drastically reduced during the interwar period. In a long, evolutionary process, the Air Force researched, developed, acquired, and fielded the weapon systems, munitions, and equipment to attack targets around-the-clock and in the weather.²²⁸ Just a small sample of the systems the Air Force fielded during this period includes: the PAVE TACK-

modified F-111F, the F-117, and the Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) system for the F-15E and F-16,²²⁹ the space-based Global Positioning System (GPS) with navigation accuracy to within 18 meters,²³⁰ other space-based assets that provide weather, communications, and intelligence-gathering capabilities to enhance targeting effectiveness, and a family of munitions and guidance systems designed to be more lethal and accurate such as the I-2000 bomb and the Paveway III laser guidance package.²³¹ These technological innovations did two things: 1) Largely eliminated the sanctuary of night,²³² and 2) increased the probability of destroying a point target with one bomb by two orders of magnitude.²³³

One organizational development stands out because of its impact on improving the ability of airpower to produce first-order effects. In 1986, Congress passed the Goldwater-Nichols Act (GNA). In the warfighting arena, GNA established a streamlined command structure with an emphasis on effective joint operations.²³⁴ The concept of the Joint Forces Air Component Commander (JFACC) emerged from this legislation.²³⁵ The JFACC concept called for a single officer to be in control of all airpower assets in the theater. A key advantage of such an arrangement is that airpower resources can be optimized in pursuit of the political and military objectives. The goal was to avoid situations like the Route Package system in Vietnam with each service fighting its own regional war.²³⁶

The next task is to examine how well the Air Force developed its thinking about how to link this increased ability to produce first-order effects to the desired outcome. For the most part, Air Force thinking on the application of conventional airpower concentrated on the Central European scenario of a Warsaw Pact invasion.²³⁷ Airland Battle doctrine, jointly developed by the Army and Air Force, established how airpower would support such a scenario.²³⁸ The Air Force would gain air superiority over the battlefield and attack the follow-on forces to slow down the enemy advance enough to enable NATO ground forces to fight a successful defensive action. The linkage of

destruction to outcome in this scenario was that airpower would inflict as much first-order destruction as possible on the transportation system to slow down reinforcements and resupply to achieve the fourth-order effect of a successful defense.

Except for Airland Battle doctrine development, there seemed to be little thought given to conventional airpower theory or its relationship to the theory of war. Many people in the Air Force considered the 1979 edition of official Air Force doctrine to be useless.²³⁹ Air Force Chief of Staff General Lew Allen, Jr., became concerned enough about the lack of interest in military and airpower history that he instituted the “Project Warrior” program to stimulate thinking in the officer corps.²⁴⁰

The increased emphasis on thinking about the foundations of airpower and the theory of war began to payoff. In 1984, the Air Force produced an improved version of AFM 1-1. Unlike past editions, the 1984 version tried to “provide an overall concept for the proper employment of air power, calling for the air commander to have a broad plan of employment and encompassing ideas delineated in World War II’s FM 100-20.”²⁴¹ In 1988, Colonel John A. Warden, III, completed a book called The Air Campaign: Planning for War in which he presented some considerations for using conventional airpower to defeat an adversary.²⁴² However, his assertions about targeting centers of gravity still rested on the same weak linkage between destruction and outcome that plagued Douhetan and ACTS theory -- that is, if you destroy the right “things” in the enemy’s homeland, they will surrender without considering whether the intermediate second- and third-order effects can be achieved. Nonetheless, Colonel Warden’s effort represented the most comprehensive work on conventional airpower theory at the operational level of war during this period.

Thus, in the years between the end of Vietnam and Desert Storm, we see an incredible increase in capability to inflict first-order effects with conventional weapons, but less of an increase in the understanding of how to link those first-order effects to the desired fourth-order effect. Precision-guided weapons, which had demonstrated their

potential in the closing years of Vietnam,²⁴³ were continuously developed during the period. By the time of Desert Storm, the Air Force possessed a robust force structure of sophisticated aircraft and a family of precision weapons designed for a variety of tasks. Realistic training and increased flying hours enhanced the proficiency of aircrews and improved the likelihood of survival in combat. Much of the thinking in the Air Force supported the Army concept of operations in a Central European scenario fighting in a defensive posture. On the eve of Desert Storm, the Air Force possessed an unprecedented potential to inflict first-order effects. The question was how well the Air Force would be able to link this potential to produce first-order effects to the desired fourth-order effect.

Planning for Desert Storm

On 2 August 1990, Iraqi military forces invaded Kuwait. In response, President Bush established a clear set of national political objectives to guide U.S. actions. These objectives were: ²⁴⁴ 1) Unconditional withdrawal of Iraqi forces from Kuwait, 2) Restore the legitimate government of Kuwait, 3) Security and stability of the Persian Gulf region, and 4) Protect American lives. The task of translating these political objectives into an executable, joint military campaign was the responsibility of General H. Norman Schwarzkopf, the Central Command Commander-in-Chief (CINCCENTCOM).

On 10 August, General Schwarzkopf, asked General Colin Powell, Chairman of the JCS, to task the Air Force to work on plans to conduct a “strategic bombing campaign aimed at Iraq’s military...”²⁴⁵ General Schwarzkopf’s request ultimately fell upon the Checkmate division on the Air Staff in the Pentagon.²⁴⁶ Led by Colonel Warden, Checkmate officers put together an operational concept for the employment of airpower. The plan, named Instant Thunder, was heavily influenced by classical strategic bombing doctrine and Colonel Warden’s ideas about how to model an enemy’s centers of gravity in terms of five concentric rings.²⁴⁷ The influence of classical strategic bombing theory

was evident in the constant references to breaking the enemy's will resulting in the achievement of victory through airpower alone.²⁴⁸ The Warden influence was evident in the prioritization of target sets based on his five-ring model and not on a detailed intelligence analysis of Iraq.²⁴⁹ While the air planners in theater refined the plan, the destruction-outcome linkage remained wedded to Warden's conceptualizations of early August 1990.

On 16 August 1990, Colonel Warden briefed General Schwarzkopf on Instant Thunder. General Schwarzkopf thought it was "a remarkably good plan."²⁵⁰ Not understanding that the plan was an Air Force strategic attack designed to be decisive in itself, General Schwarzkopf described it as a "retaliatory package."²⁵¹ The real offensive operation, in General Schwarzkopf's conception, would not start until the ground units were engaged in combat and he wanted to know how long it would take to complete Instant Thunder.²⁵² Colonel Warden estimated it would take six days.²⁵³ Furthermore, it would take an additional four days to gain the necessary air superiority over Kuwait before any ground campaign could take place.²⁵⁴ In General Schwarzkopf's words, "Warden had come up with a strategy designed to cripple Iraq's military without laying waste to the country."²⁵⁵ At this meeting, General Schwarzkopf outlined a four-phased campaign that would become the basis of Desert Storm:²⁵⁶ 1) Phase I - the Strategic Air Campaign (refined Instant Thunder), 2) Phase II - Air Supremacy over Kuwait, 3) Phase III - Battlefield Preparation, and 4) Phase IV - Ground Offensive.

General Schwarzkopf directed Colonel Warden to hand off Instant Thunder to General Charles Horner, the air component commander for CENTCOM, in Riyadh, Saudi Arabia. Over the next five months, General Horner's planners refined the target prioritization based on the ten target sets defined in the plan.²⁵⁷ Unencumbered with numerous political restrictions²⁵⁸ and in a theater of operations that favored the use of airpower,²⁵⁹ General Horner's planning cell, known as the "Black Hole," tried to match up projected sorties, weapons systems, and weapons against the target list. In a

significant difference from World War II, Korea, and Vietnam, the Black Hole planners decided not to destroy a single target set before moving on to another target set. Instead they distributed the available sorties among as many target sets as possible. This “parallel attack,” as it was called after the war, resulted not from some new concept of warfare, but from the desire to inflict the maximum amount of damage to the Iraqi military machine before it could withdraw from Kuwait.²⁶⁰ This left the attack of the transportation system as just one of several target sets that would be under attack at any given time.

However, the transportation system did receive some priority because of General Schwarzkopf’s desire to keep the Iraqi military from trying to leave Kuwait. Since one of the political objectives was stability in the region, this meant Saddam’s military capability had to be reduced. If Saddam removed his army from Kuwait with most of its equipment, then the long-term stability of the region would still be questionable. For this reason, General Schwarzkopf wanted the escape routes from Kuwait and southern Iraq closed.

The transportation system supporting the Iraqi forces in southern Iraq and Kuwait was fairly simple. It consisted of a single rail line from Baghdad to Basra as well as two major roads that paralleled the Euphrates and Tigris rivers. The railroad line had a capacity of 11,000 tons/day and the roads had a capacity of 200,000 tons/day.²⁶¹ Furthermore, the Iraqis enhanced the transportation system within Kuwait by building more than 2000 kilometers of roads, a 150 kilometer railroad spur to connect Kuwait City to the Iraqi rail line, and added a 100 kilometer water pipeline connecting southern Iraq with Kuwait.²⁶² The Black Hole planners had approximately 60 targets in the “rail and road bridge” category as well as 7 railyards.²⁶³ Despite the historical precedents of attacking transportation systems, planners believed that the transportation system supporting the Iraqi army in Kuwait could be shut down.²⁶⁴

In summary of the planning effort, we see that the influence of Colonel Warden's five-ring-model dominated the conceptualization of the air campaign. Intelligence analysis played only a very small part in the conceptualization and was used primarily to locate targets to put into each of the ten target categories. It is not clear at this point exactly how the planners envisioned that the destruction of targets within the target categories contributed to second- and third-order effects.²⁶⁵ As in past air campaigns, there was a strong belief in the effectiveness of airpower in breaking the will of the people. Black Hole planners believed the strategic campaign would somehow convince the Iraqi people that they would be better off if they removed Saddam from office.²⁶⁶ The air planners believed they could craft a strategic air campaign that would produce a victory in itself.²⁶⁷ Destruction was linked to outcome by inflicting as much damage as possible against the target sets in the priority defined by Colonel Warden's five-rings. The destruction-outcome linkage for transportation was very similar to the linkage used in the Korean War for Operation Strangle. If enough destruction could be inflicted on the transportation system to reduce capacity below what was required to sustain the Iraqi army in Kuwait, the Iraqis would be forced to leave.

Execution of Desert Storm

The attack on the transportation system supporting the Iraqi army was accomplished throughout the 43-day war. Approximately 800 attacks were made against the road and rail bridges in Iraq.²⁶⁸ In addition, there were over 38,000 sorties flown in the interdiction mission category.²⁶⁹ Many of these interdiction missions had no specific target, but instead were free to strike targets of opportunity which in many cases involved some part of the transportation system within Kuwait such as trucks. By the time the ground war started, the attacks on transportation to Kuwait and within Kuwait had contributed to reducing much of the Iraqi army to a state of combat non-readiness.

Attacks by airpower had reduced the capacity of the transportation system from 200,000 tons/day to approximately 60,000 tons/day by the time the ground campaign

started and 20,000 tons/day at the end of the war.²⁷⁰ Despite the reduction in capacity, the resupply requirements of the Iraqi army in a static operational posture were being met.²⁷¹ The Iraqis reacted just as the North Koreans and North Vietnamese did when their transportation system came under attack -- they found workarounds to the first-order effects such as building temporary bridges, re-routing traffic and using ferries to cross rivers.²⁷² While the Iraqis' work-arounds were not new, the extent to which airpower could operate around-the-clock against the transportation system using systems such as the F-111F, F-117 and F-15E was.

Although the Iraqis may have been able to get a subsistence level of supplies into Kuwait, they encountered enormous difficulties in moving these supplies within Kuwait. With coalition aircraft constantly prowling overhead looking to strike moving vehicles, it became very dangerous to drive a truck in Kuwait. The cumulative result of the attack of transportation within Kuwait was that the distribution system was unable to adequately supply the frontline infantry divisions.²⁷³

In summary, airpower in Desert Storm was most impressive in the amount of first-order destruction inflicted with orders of magnitude fewer sorties and in a much more compressed time period than previous conflicts. In a matter of six weeks, the attack on the transportation system reduced the capacity from 200,000 tons/day to 20,000 tons/day. The distribution system within Kuwait itself was rendered ineffective. Even though the Iraqis had large stockpiles of food, ammunition, and fuel in theater, the frontline troops were unable to get access to these stockpiles, just as the Germans were unable to get supplies to their frontline troops during Overlord. The start of the ground war and the ensuing Iraqi exodus from Kuwait ended any chance to see if the Iraqis could have been "strangled" out. Four days after the start of ground war, the Iraqis agreed to a cease-fire.

Analysis

Just like the Transportation Plan of World War II, Desert Storm was successful in achieving the desired political and military objectives. Airpower had created adverse conditions for the enemy that enabled the ground forces to succeed. Saddam, like Hitler, made errors in judgment about where the allied ground assault would take place and the effectiveness of airpower.²⁷⁴ Once again, people would argue about what conditions had been created and how those conditions contributed to the victory. Simply put, what mechanism allowed the Iraqi army to be defeated and expelled from Kuwait in a 100-hour ground war?²⁷⁵ Was it a clearer understanding and conscious application of the Destruction-Outcome Linkage Model? Was it, as some people have asserted, that technology finally gave airpower the ability to break the enemy's will envisioned by Douhet and the ACTS?²⁷⁶ The more likely explanation is that it was not a clear adherence to the Destruction-Outcome Linkage Model so much as it was the defeat of an adversary led by a militarily incompetent leader who let us use our ability to inflict first-order destruction to decimate his forces in the field.

Two schools of thought are discernible in the debate over the linkage between destruction and outcome in Desert Storm. One is the "strategic paralysis" school and the other is the "denial of military strategy" school. The "strategic paralysis" school argues that by striking the right combination of strategic targets with airpower, an adversary can be rendered incapable of functioning or responding effectively. The quickest way to achieve paralysis is by "decapitating" the leadership, either physically or functionally.²⁷⁷ The "denial of military strategy" school, on the other hand, maintains that the path to success is to convince the adversary's leadership that their military strategy will not work.²⁷⁸ The systematic destruction of the Iraqi's transportation system to and within Kuwait, this school argues, contributed to the fourth-order effect by convincing Saddam his military strategy to hold onto Kuwait would not succeed.

It seems, in retrospect, that the strategic campaign did not result in "paralysis" of the Iraqi regime, nor did it cause the overthrow of the Saddam.²⁷⁹ For example, the

strategic attack of electricity reduced the Iraqi power system to 88% of its prewar output,²⁸⁰ but this may not have had much of an impact on Iraqi military strategy.²⁸¹ The Iraqis successfully dispersed and concealed much of their nuclear research operation. Although telecommunications were degraded, Saddam communicated with his field commanders to the very end of the war. Saddam seemed willing to accept complete domination of the air by allied forces and to absorb the strategic air attack much like a Mohammed Ali “rope-a-dope” strategy.²⁸² There is no doubt the strategic campaign produced difficulty and friction for the Iraqi leadership. However, it does not appear that the Iraqi regime was ever “paralyzed” in the sense its advocates define the term. The strategic attack of Iraq did not deny Iraq its military strategy for holding onto Kuwait.

What threatened Saddam’s military strategy was the unrelenting attack on the fielded forces in the Kuwait Theater of Operations (KTO). Phase III of the Desert Storm campaign plan called for “preparation of the battlefield.” The air planners saw it more accurately with their slogan, “We are not preparing the battlefield, we are destroying it.” Because of the amount of airpower available and General Schwarzkopf’s direction to produce 50% attrition in the Republican Guard forces, the destruction of the battlefield started on the first day of the air war. By the eighth day of war, on 25 January, the majority of the strikes were against the fielded forces.²⁸³ With the destruction mounting, it is conceivable that Saddam calculated the risk of losing a significant portion of his elite Republican Guard division as too high.²⁸⁴ Day-by-day the air attacks were destroying his army. Airpower easily defeated his only attempt to ignite the ground war at Al-Khafji.²⁸⁵ It seems reasonable to assume that Saddam realized his military strategy of assuming a defensive posture in Kuwait, designed to inflict maximum casualties to the U.S. forces in a ground war, was not going to work. If he left his forces in the KTO to follow his military strategy, most of their equipment would eventually be destroyed, leaving him less powerful and more vulnerable to a coup.

Never before in history has conventional airpower produced the amount of first-order destruction against such a wide range of targets in so short a time. The Iraqi distribution system in the KTO was rendered ineffective. In combination with the attacks on other target systems, especially military equipment (tanks, artillery, supply depots), the attack on transportation made it nearly impossible for Saddam's army to avoid the attrition that was being inflicted on it. Saddam's military strategy of holding onto Kuwait in an intimidating defensive posture had been defeated through the third-order effects of the attacks on transportation and the third-order effects from the attacks on equipment. The Iraqis were unable to compensate for the damage to their transportation system in the KTO by changing their military strategy because of the simultaneous attrition of their military equipment. This combination was the mechanism that produced the desired fourth-order effect -- the Iraqis were removed from Kuwait.

Did the planners in Checkmate realize this combination was the key to achieving the fourth-order effect? Checkmate planners believed that the efficacy of strategic attack, based on the notional idea of Colonel Warden's five-rings, was the key to achieving a fourth-order effect even though they had not made a convincing explanation of the destruction-outcome linkage. Much of this philosophy was part of the Black Hole's thinking as well. The planners linked destruction to outcome in a very general sense as evidenced with their planned effects such as "attrition of the Iraqi army by 50%" or "cutting supply lines."

It was in the execution of Desert Storm where the Black Hole planners did something exceptional with airpower. They had enough airpower assets to rapidly reduce the Iraqi transportation system supporting the KTO to 10% of its prewar capacity with a historically very small number of sorties. While this did not reduce the capacity below the level required to maintain resupply of a static Iraqi army, it ensured that when, and if, the ground war started, the Iraqi's would not be able to supply enough materiel to support combat operations. The introduction of innovative tactics, such as the use of

“kill boxes” with F-111Fs delivering LGBs²⁸⁶ and F-16 “Killer Scouts” to improve target identification,²⁸⁷ contributed to inflicting first-order effects. Shifting the weight of effort to the KTO produced first-order effects in such overwhelming volume that the Iraqis could not compensate for the damage with sufficient workarounds.

In sum, the ability to produce first-order destruction masked any weaknesses there might have been in analyzing the destruction-outcome linkage.²⁸⁸ The U.S.-led coalition was going to defeat Saddam. The relatively low losses in lives and materiel were more a function of the amount of first-order destruction inflicted against Saddam’s military strategy than any prewar destruction-outcome linkage or the strategic attack conducted against Iraq.²⁸⁹ The extremely favorable conditions for airpower application, and an adversary led by someone who did not understand what he was up against, are not circumstances likely to be repeated. The claims that airpower created a revolution in warfare, especially the capability to produce “strategic paralysis” as mechanism for victory, would seem to be premature.²⁹⁰ Desert Storm did demonstrate that under extremely favorable circumstances and conditions that *an overwhelming ability to produce first-order effects can overcome any weaknesses in clearly and convincingly linking destruction to outcome*. In the next war, it is unlikely our adversary will permit us to get away with this.²⁹¹

Summary

In this chapter, we have examined the development of airpower in the period between Vietnam and Desert Storm and the planning and execution of Desert Storm with an emphasis on the targeting of transportation. Finally, we analyzed Desert Storm using the Destruction-Outcome Linkage Model. The planning was driven by the desire to win war through strategic attack of Iraq based on Colonel Warden’s five-ring model. Ironically, it was not the strategic attack, in which Air Force planners devoted so much time and effort, that produced the conditions for the 100-hour ground war, but the defeat of Saddam’s military strategy for holding onto Kuwait. However, in both cases, the

strategic attack and the preparation of the battlefield, the analysis that linked destruction to outcome could have been better.

Notes

215 Gulf War Air Power Survey Summary Report (Washington, DC: United States Government Printing Office, 1993), 95. The Gulf War Air Power Survey consists of five volumes and a summary report. Hereafter, it will be referred to as “GWAPS” and the appropriate volume and part number.

216 For examples, see Michael R. Gordon, “Generals Favor 'No Holds Barred' By U.S. if Iraq Attacks the Saudis,” New York Times, 25 August 1990, 1. and Rowan Scarborough, “General Predicts Violent, Fast War,” Washington Times, 21 December 1990, 3.

217 Even during the war, President Bush shunned micromanagement to the extent possible. See Frank J. Murray, “Bush Scrupulously Avoids Making Military Decisions,” Washington Times, 23 January 1991, B-1.

218 There were political restraints specified, but nothing like what was done during Vietnam when the White House specified targets, bomb loads, and delivery tactics.

219 Yuen Foong Khong, Analogies at War (Princeton, NJ: Princeton University Press, 1992), 260. After the war, President Bush told troops who had returned from Desert Storm that they had “liberated America from the ghosts and doubts left over from Vietnam.” See Frank J. Murray, “Bush: Vietnam ‘Ghosts’ Exorcised,” Washington Times, 18 March 1991, 1.

220 By 1987, the Air Force position was that “Strategic strength underwrites deterrence across the spectrum of conflict and a high priority is placed on it but not at the expense of conventional capabilities.” See Office of the Vice Chief of Staff of the Air Force, Air Force Issues Book, Spring 1987, 2-2. With respect to training, there was far more attention paid to training aircrews how to fly and fight in a high-threat conventional environment. Red Flag began in 1975 and expanded to include Green Flag and Maple Flag. Major commands also have their own set of training exercises to increase aircrew proficiency. The increased proficiency means increased first-order effects because the target is more likely to be hit and the crew is more likely to survive. See Michael Skinner, Red Flag (Novato, CA: Presidio Press, 1984), 7-21. Also see Major Robert J. Hamilton, “Green and Blue in the Wild Blue: An Examination of the Evolution of Army and Air Force Airpower Thinking and Doctrine Since the Vietnam War,” School of Advanced Airpower Studies Thesis, Maxwell AFB, AL, 1993, 22-53, for a good discussion of the evolution of airpower doctrine from 1972 to 1992.

221 This is not to argue that there should be no restraints in war. There will always and must always be restraints. The question addressed here is a matter of *degree*. What is the tradeoff between restraints and sound military application of power? This is the question that was addressed in the aftermath of the Vietnam War.

222 Khong, 258-263.

223 For examples, see Momyer, 33-34, 339; and Admiral U.S.G. Sharp, Strategy for Defeat: Vietnam in Retrospect (Novato, CA: Presidio Press, 1978), 267-271.

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- 224 Some people argue that such an assessment is nothing more than the perpetuation of a myth. See Tilford, 288-297; and Clodfelter, ix, 207-210.
- 225 One might also argue the debacle of the Iranian hostage rescue attempt in 1980, and the 1983 involvement in Lebanon contributed to the increased attention on the effect of political restraints on the use of force.
- 226 George C. Wilson, "Weinberger Bids U.S. Be Cautious - Warning Is Sounded On Use Of Military For Unclear Goals," Washington Post, 29 November 1984, 1.
- 227 Ibid.
- 228 The F-111, F-16, and F-15E all have the capability to hit targets around-the-clock and in the weather using ground mapping radar. The F-111F with PAVE TACK and the F-16 and F-15E with the LANTIRN targeting pod have the capability to deliver laser-guided bombs.
- 229 In Desert Storm, the LANTIRN targeting pod was only available in very limited numbers.
- 230 "Air Force Alters GPS to Aid Troops," Space News, 24-30 September 1990, 3.
- 231 For a good chronology of the development of precision weapons, see Major Donald I. Blackwelder, "The Long Road to Desert Storm and Beyond: The Development of Precision Guided Bombs," School of Advanced Airpower Studies Thesis, Maxwell AFB, AL, May 1992.
- 232 Good weather is still required to guide a precision-guided munition because infrared sensors cannot "see" through certain atmospheric conditions such as cloud and high relative humidity. However, it will only be a matter of time before this limitation is overcome with munitions that use self-contained guidance systems.
- 233 As an example, to achieve a 90% probability of kill using 2000-pound bombs (unguided or "dumb") required that 176 of them be dropped from an F-4 in 1970. It took just one LGB to achieve the same probability of kill in Desert Storm. See Department of the Air Force, "Global Reach, Global Power: The Evolving Air Force Contribution to National Security," December 1992, 12.
- 234 One of the primary goals of GNA was to make joint operations work more effectively.
- 235 The Air Force has taken the lead on developing the JFACC concept. Centralized control of air assets has long been advocated by the Air Force to maximize the combat effectiveness of available airpower. The current official Air Force thinking on the JFACC can be found in HQ USAF/XOXD, The JFACC Primer (Washington, DC: US Government Printing Office, August 1992).
- 236 The JFACC concept has not been warmly embraced by the Army, Navy, and Marines. For a number of reasons, many of them parochial, they do not endorse the JFACC concept. The Marines, for example, expect to have their own piece of airspace around their ground forces which they can control to assure themselves of organic close air support. See Major Thomas X. Hammes, "Rethinking Air Interdiction," Proceedings of the U.S. Naval Institute 113, no. 12 (December 1987), 50-55.

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- 237 Keeping the strategic nuclear deterrent force viable was also a priority. One need only look at the amount of money spent during the 1980s on the B-1B, the follow-on ICBM to the Minuteman III, the advanced cruise missile, the B-2A, etc., to verify its importance. But after Vietnam there was a growing awareness that the strategic nuclear forces were of limited utility in the most likely conflicts.
- 238 Colonel Thomas A. Cardwell III, Airland Combat: An Organization for Joint Warfare (Maxwell AFB, AL: Air University Press, 1992), 49-87.
- 239 Colonel Dennis M. Drew, "Two Decades in the Air Power Wilderness," Air University Review 37, no. 6 (September - October 1986), 12.
- 240 Hamilton, 37.
- 241 Colonel Clifford R. Krieger, "USAF Doctrine: An Enduring Challenge," Air University Review 35, no. 5 (September-October 1984), 17.
- 242 Colonel John A. Warden III., The Air Campaign (Washington, DC: Pergamon-Brassey's, 1989).
- 243 Just one example of the effectiveness of LGBs was the attack of the Thanh Hoa bridge. This bridge was a link from Hanoi/Haiphong to the south. Forty-three aircraft were shot down during Rolling Thunder trying to drop this bridge. On 13 May, 1972, it was dropped in a single strike by F-4s using LGBs. See Colonel John A. Doglione, et al., "Airpower and the Spring Invasion of 1972," Air War College Research Report, Maxwell AFB, AL, 1975, 197, AFHRA File No. K239.032-39.
- 244 GWAPS: Planning, Vol. I. Part I, 83.
- 245 General H. Norman Schwarzkopf, It Doesn't Take a Hero (New York: Bantam Books, 1992), 313.
- 246 Responsibility for planning the air campaign belonged to the Air Component Commander of CENTCOM (CENTAF). However, the early deployment phase of Desert Shield was so intense that there was little free time to put together a comprehensive air campaign plan. Furthermore, according to Dr. Williamson Murray, "...at the beginning of August 1990 Tactical Air Command proved incapable of conceiving of any air role for its forces other than serving as the Army commander's long-range artillery." Dr. Murray credits Colonel Warden's targeting strategy for much of the success of Desert Storm. Dr. Williamson Murray, "Air Power since World War II: Consistent with Doctrine?," The Future of Air Power in the Aftermath of the Gulf War, eds. Richard H. Shultz Jr., and Robert L. Phaltzgraff Jr. (Maxwell AFB, AL: Air University Press, 1992), 109.
- 247 Warden depicts the centers of gravity as five concentric rings. Starting with the most important innermost ring and moving outward to the least important are: leadership/command; essential production; the transportation network; population; and fielded military forces. See Colonel John A. Warden III, "Employing Air Power in the Twenty-first Century," The Future of Air Power in the Aftermath of the Gulf War, 64-65.
- 248 For examples, see GWAPS: Planning (Washington, DC: United States Government Printing Office, 1993) Vol. I, Part I, 93, 113, 232. This enthusiasm for the strategic decisiveness of Instant Thunder was not shared by everyone, including General Horner. See *Ibid.*, 127.

249 Most of the target sets used by the Checkmate planners were not any different than those target sets identified in previous air campaigns with perhaps the exception of leadership/command and telecommunications. With respect to the lack of intelligence analysis, GWAPS noted that "...the idea of a strategic air campaign rested upon only the most general understanding of Iraq, its society, infrastructure, and military capabilities." See GWAPS: Planning, Vol. I, Part I, 214.

250 Schwarzkopf, 318.

251 Ibid., 319.

252 Both General Schwarzkopf and General Powell shared the common Army view that the only path to victory was through defeat of the enemy army in ground combat. As General Schwarzkopf put it, "Colin Powell and I understood very early on that a strategic bombing campaign in and of itself had never ever won a war and had never forced anybody to do anything if they wanted to sit it out." See George J. Church, "The 100 Hours," Time 137, no. 10 (11 March 1991), 27. This view is also shared by mid-level Army officers and is part of Army doctrine. See Major Charles H. Jacoby Jr., "In Search of Quick Decision: The Myth of the Independent Air Campaign," School of Advanced Military Studies Thesis, Fort Leavenworth, KS, 1991.

253 Schwarzkopf, 319; Eliot Cohen, GWAPS: Planning (Washington, DC: United States Government Printing Office, 1993) Vol. I, Part I, 169. It should be noted the number of targets increased from 84 on 21 August to 481 by 15 January. GWAPS: Effects and Effectiveness (Washington, DC: United States Government Printing Office, 1993) Vol. II, Part II, 134.

254 Schwarzkopf, 319.

255 Ibid., 318.

256 GWAPS: Planning (Washington, DC: United States Government Printing Office, 1993) Vol. I, Part I, 148; Schwarzkopf, 320. Bob Woodward, The Commanders (New York: Pocket Star Books, 1991), 289.

257 The ten target sets were Instant Thunder were as follows: 1) National leadership facilities, 2) National telecommunications and C3, 3) Oil distribution and storage, 4) Electric power, 5) Railroads and bridges, 6) Nuclear/chemical/biological warfare capabilities, 7) Military research/production/storage, 8) Strategic air defenses, 9) Airfields, and 10) Iraq's ballistic missile capabilities. GWAPS Summary Report, 136.

258 The major political restrictions were limited to the following: 1) Noncombatant casualties held to a minimum, 2) Harm to structures of cultural and religious significance to the Iraqi people would be avoided, 3) Damage to the Iraqi economy and its capacity for recovery would be limited, 4) Lives of the hostages held by Iraq would be protected to the extent possible, and 5) Nuclear weapons would not be used. See GWAPS: Planning, Vol. I, Part I, 90. Most importantly, there was political resolve not to micromanage operational strategy and tactical decisions. It should also be noted that the end of the Cold War helped take much of the pressure off imposing numerous political restraints.

259 Some of the factors that favored airpower include: wide open desert terrain which made it more difficult for Iraqi forces to hide, relatively good weather, and high-value, discrete targets vulnerable to air attack. See Michael J. Dugan, "Operational Experience and Future Applications of Air Power," The RUSI Journal 137, no. 4 (August 1992), 38.

260 GWAPS: Planning, Vol. I, Part I, 164-165. The reason the most important targets in each target set were hit as quickly as possible was because of a fear the air war would not be allowed to go “for more than a few days.” So General Glosson directed his planners to “hit every strategic target in Iraq as quickly as possible.” See GWAPS: Command and Control, Vol. I, Part II, 227.

261 GWAPS: Effects and Effectiveness, Vol. II, Part II, 192.

262 GWAPS: Planning, Vol. I, Part I, 73.

263 GWAPS Summary Report, 92.

264 General Glosson commented on 18 October, 1990, that the planned air campaign would make “it for all practical purposes impossible for him [Saddam] to resupply the troops that he has in Kuwait. So once you’ve done that, the only thing you have to do is have the patience to wait out the effect of what you’ve already accomplished.” He went on to predict that 10 days after the strategic campaign was completed the Iraqi army would begin to run out of food and water. See GWAPS: Planning, Vol. I, Part I, 171.

265 In a chart depicting “Desired/Planned Effects” and “Actual Results” for the Railroads/Bridges, the “Desired/Planned Effects” were simply “Cut supply lines to KTO” and “Prevent retreat of Iraqi forces.” Under “Actual Results” were “All important bridges destroyed,” “Many Iraqi workarounds,” and “Short duration of war limited effects.” From this chart, second- and third-order effects cannot be discerned. At best the “Prevent retreat of Iraqi forces” can be considered a second-order effect. The “All important bridges destroyed” is a first-order effects description and reflects the long-standing belief that if enough “things” are destroyed, the desired effect will be achieved. See chart in GWAPS: Effects and Effectiveness, Vol II, Part II, 349.

266 One Black Hole planner thought that targeting electricity would send the “message” to the Iraqi people that “your lights will come back on as soon as you get rid of Saddam.” See GWAPS: Planning, Vol. I, Part I, 93. What the planners either did not know or ignored was the historical difficulty of translating poor attitude and morale on the part of the population being bombed into action against their government. As the German Internal Security Service found out in World War II, it was harder for *Stimmung* (attitude or feeling) to influence *Haltung* (behavior) than thought and accounts for part of the reason why the German people did not rise up against Hitler. It is difficult to see how, through only indirect means such as the denial of electricity and communication, the Iraqi people would rise up against Saddam. See Bernard Brodie, Strategy in the Missile Age, 132. According to GWAPS, the “U.S. thought the political regime was the weak link but actually the Iraqi military was the weak link...airmen would do well to remember that even direct attacks on centers of gravity have had little effect on the *political* stability of regimes under attack.” GWAPS: Operations, Vol. II, Part I, 331. Furthermore, on 8 January, 1991, several State Department officials briefed President Bush and his advisors on the improbability of the Iraqi people rising up against Saddam. See Woodward, 347.

267 According to GWAPS, “What was most central to the Desert Storm air campaign plan was the planners’ own vision of success, their own vision of victory. By concentrating all their efforts toward the first phase of the overall theater campaign plan, they implicitly stated their vision that air power alone would prevail and victory would come within the first week.” See GWAPS: Planning, Vol. I, Part I, 232.

268 GWAPS: Effects and Effectiveness, Vol. II, Part II, 177-178.

269 GWAPS: Statistical Compendium, Vol. V, Part I, 234-241.

270 GWAPS: Effects and Effectiveness, Vol. II, Part II, 189-191. The single rail line was completely shutdown severely limiting the Iraqis ability to move armor to Kuwait.

271 GWAPS: Effects and Effectiveness, Vol. II, Part II, 193-194. This is revalidation of a recurring lesson about the supply requirements of a static army. It has been the case in World War II, Korea, and Vietnam, that when an adversary's army was not being pressured with ground action, its resupply needs were met despite extensive reduction in overall capacity of the transportation system supporting it.

272 GWAPS Summary Report, 94.

273 GWAPS: Effects and Effectiveness, Vol. II, Part II, 201.

274 "...Iraq's own strategy must bear a significant portion of the responsibility for the speed and thoroughness of its defeat." See Norman Cigar, "Iraq's Strategic Mindset and the Gulf War: Blueprint for Defeat," Journal of Strategic Studies 15, no. 1 (March 1992), 1.

275 The answer to this question presents some difficulty. A considerable amount of intelligence information will remain highly classified for many years to come. There may be information that will fundamentally change the interpretation of events when it is eventually released. For example, when the fact that the British were decoding German communications with Ultra became public 30 years later, it changed the interpretation of certain actions in World War II. Thus, this unclassified analysis of Desert Storm can only be considered tentative at best. Furthermore, the sheer volume of data generated from the conflict will require many years of analysis before any definitive answers can be distilled.

276 Pronouncements about Douhetan theory being validated by Desert Storm are especially difficult to prove when that theory is closely scrutinized by comparison with what actually took place in Desert Storm. See Claudio Segre, "Guilio Douhet: Strategist, Theorist, Prophet?" Journal of Strategic Studies 15, no. 3 (September 1992), 351-366.

277 The decapitation approach is presented in Warden, The Air Campaign, 117. He describes it as going after the "political center of gravity -- the capital or king" and that it "promises to be the quickest and cheapest..." The only evidence to support this assertion is through analogy with dynastic warfare.

278 According to Robert Pape, "The task...is to thwart the victim's military strategy, undermining the victim's confidence that its territorial goals can be achieved." See Robert A. Pape Jr., "Coercion and Military Strategy: Why Denial Works and Punishment Doesn't," Journal of Strategic Studies 15, no. 4 (December 1992), 431.

279 Some commentators, during the Desert Storm air campaign, inferred that the air attacks were going to motivate the Iraqi people to get rid of Saddam. "The inability to process and ship food or continue making ammunition also has a long-term impact. Iraq is not a backward agricultural society; it is an industrialized and urbanized country with a well-educated people. Some 10 years of industrial development is being demolished, and Iraqis should see that their lives are being made miserable." See General Michael Dugan, "The Air War," U.S. News and World Reports 110, no. 5 (11 February 1991), 28.

280 GWAPS: Effects and Effectiveness, Vol. II, Part II, 349.

281 Griffith, 70-71. Griffith argues that, "To strike electrical power to affect civilian morale, increase costs to the leadership, or impact the military will waste missions and could prove counterproductive to the political aims of the war."

282 Mohammed Ali's rope-a-dope strategy was to let his opponent exhaust himself while Ali would hunker in a defensive position against the ropes. He would maintain the defense until he sensed his opponent had given it his best shot at which point he transitioned to the offensive.

283 GWAPS: Effects and Effectiveness, Vol II, Part II, 269.

284 Saddam has a layered internal security system designed to keep him in power. The Republican Guards are a key part of the system. He knew that the loss of the Republican Guards increased the risk to his life and his grip on power.

285 The Iraqis tried to start the ground war by attacking Al-Khafji in Saudi Arabia on 30 January, 1991. The Iraqis, operating in the open without air cover were soundly defeated by air attack. See GWAPS: Effects and Effectiveness, Vol II, Part II, 101-102.

286 The F-111Fs in the kill boxes were to drop their LGBs "on any tank, APC, truck, artillery piece, command-and-control bunker, or supply dump that crews could find in their [kill] box." Major Michael J. Bodner, and Major William W. Bruner III, "Tank Plinking," Air Force Magazine 76, no. 10 (October 1993), 30.

287 Lieutenant Colonel Mark A. Welsh, "Day of the Killer Scouts," Air Force Magazine 76, no. 4 (April 1993), 70.

288 It also masked flaws in the role of the intelligence with both Checkmate and the Black Hole. In mid-October, 1990, General Glosson stated there was, "a total breakdown in intel's' ability to support our [the Black Hole's] effort." Glosson relied on a direct link to Rear Admiral Michael McConnell in the Defense Intelligence Agency and without this support "We would have actually looked inept at times due to a lack of intelligence." See GWAPS: Command and Control, Vol. I, Part II, 182. The in-theater intelligence division (CENTAF/IN) saw the rift between operations and intelligence this way: "Theater intelligence planners contended that targets were attacked unnecessarily because of the way information entered the Guidance, Apportionment, and Targeting Cell (GAT) [formerly the Black Hole]. Intelligence officers argued that targets selected and struck often (a) did not meet Commander in Chief, Central Command targeting objectives, (b) did not have the appropriate preparatory analysis to identify aim point and desired mean points of impact, and (c) bypassed standard target material production." See GWAPS: Command and Control, Vol. I, Part II, 202. Furthermore, "...the evidence shows that bomb damage assessment was often inadequate or non-existent, and communications between the GAT and the wings were often confusing...the control of operations exercised by the GAT planners was constrained by their lack of adequate BDA and by their conflicts with CENTAF/IN." See GWAPS: Command and Control, Vol. I, Part II, 263. Had the U.S. faced a more capable adversary, this disconnect between operations and intelligence could have caused serious problems.

289 While we have discussed how the planners were able to increase the first-order destruction, it seems there was little feedback as to how this first-order destruction was impacting the enemy. According to GWAPS, "At each level of CENTAF, key and significant officers believed they were managing the chaos of war. However, when the activities of the many significant participants are pieced together, the problem is that neither planners nor General Horner...knew the details of what was happening in the air campaign or how well the campaign was going." See GWAPS: Command and Control, Vol. I, Part II, 264.

290 In the aftermath of Desert Storm, there has been a great deal written about the revolution in warfare, especially the notion that Desert Storm finally proved an enemy could be defeated by airpower alone. For

example, according to Major Jason Barlow, “Airpower has grown up and come of age. The old notion that conflicts can be resolved from the air, without annihilating the enemy, is now a real possibility.” See Barlow, 116.

²⁹¹ It is possible our next adversary will attempt to use an “asymmetric strategy” against us, avoiding any attempt to fight our airpower directly. Rather than trying to acquire a modern, high-tech air force that costs a considerable amount of money, they might try to get a low-tech counter to our airpower.

Chapter Seven

Conclusion

“The effective employment of air- and spacepower has to do not so much with airplanes and missiles and engineering as with thinking and attitude and imagination.”²⁹²

- General Merrill A. McPeak

This paper has addressed the question of how well airpower strategists have linked destruction to outcome over the last 50 years by examining four major air campaigns. We have analyzed how airpower strategists have conceptualized this linkage, applied it to past air campaigns, and the extent to which their conception of the linkage matched results achieved in combat. The study of these four air campaigns suggests that airpower strategists have improved their ability to link destruction to outcome only marginally, if at all. Airpower strategists have regularly overestimated the ability of the Air Force to inflict first-order destruction and underestimated the adversary’s ability to cope with and compensate for the destruction.

To provide a framework for our analysis, we presented the Destruction-Outcome Linkage Model. Doctrine, force structure, technical capability, weapons, training, command structure, political constraints, and contextual elements all affect airpower’s capability to produce first-order effects. To evaluate the first-order effects there must be effective feedback mechanisms. These include battle damage assessment systems and strategic intelligence assets. Measures of merit such as number of bridges destroyed, tons of bombs dropped, sorties flown, trucks destroyed, etc., are meaningless unless they are related to how they affect the adversary’s leadership’s perceptions and military strategy. The feedback gets increasingly difficult to obtain as you move up the hierarchy

of the model, but it is vital to success. Linking destruction to outcome is a dynamic process involving constant evaluation of the targeting effectiveness.

Using the Destruction-Outcome Linkage Model, we analyzed each of the four major air campaigns. A variety of observations were made in the preceding four chapters from which a series of implications can be drawn. These implications include:

1. Parochial considerations will likely drive organizational perceptions about the destruction-outcome linkage. In all the campaigns studied in this paper, this was a recurring theme. The U.S. airmen fought the Transportation Plan in World War II because it did not match their perceptions about the best use of airpower to achieve the defeat of Germany. In Instant Thunder, the planners thought the outcome could be achieved with the strategic air campaign, while Army leaders saw the ground war as the mechanism necessary to achieve the outcome.
2. The ability of airpower to break the will of the adversary will be overestimated. From Major Muir Fairchild's estimation that one-hundred well-placed bombs could bring the U.S. to ruination to the Instant Thunder planners' estimation that destruction of fewer than 100 targets in Iraq would produce the desired outcome, airpower strategists have consistently overestimated the ability of airpower to break the enemy's will.
3. The capability of the adversary to respond to second- and third-order effects will be underestimated. There has been a consistent failure to understand how the enemy compensates and substitutes for attacks on its target systems. As the example of the transportation system has shown, the adversary can find work-arounds and implement countermeasures.
4. Reduction in the ability to inflict first-order effects will reduce the likelihood of achieving the desired outcome. Limitations in the ability of airpower to produce first-order destruction have included technological shortfalls, organizational inefficiency and political restraints. No matter how well conceived the destruction-outcome linkage may be, the outcome will not be realized unless first-order effects can be inflicted at a rate that

exceeds the adversary's capability to repair damage. This was a significant factor in the failure of the air campaigns in Korea and Vietnam.

5. Overwhelming ability to inflict first-order effects may mask deficient analysis of the destruction-outcome linkage. Nuclear weapons, for so long the focus of Air Force thinking in the post-World War II era, could inflict such enormous first-order destruction that they permitted the Douhetan/ACTS destruction-outcome linkage to flourish. Conventional capability to inflict first-order destruction was very limited until the 1980s when the Air Force fielded weapon systems and support systems that gave it orders of magnitude improvements in accuracy. In Desert Storm, the overwhelming conventional airpower capability was used with great effectiveness to systematically destroy a non-reactive enemy army. This capability masked the deficiencies of the strategic air campaign's destruction-outcome linkage.

6. Linking destruction to outcome will be an extraordinarily difficult task requiring accurate intelligence assessment systems and processes, and airpower strategists with highly developed cognitive skills. As Clausewitz pointed out, war is filled with fog, friction and chance. It will take a combination of sound strategic intelligence and officers with the ability to analyze this intelligence using their knowledge of war and airpower theory to produce a meaningful destruction-outcome linkage for the air campaign.

Much of the problem associated with linking destruction to outcome can be attributed to the airpower theory developed in the years prior to World War II and the development of the nuclear weapons that seemed to validate the theory. The Douhetan assertions about the efficacy of airpower breaking the will of the people or coercing them to rise up against their government because of the hardships they are suffering due to bombing are yet to be proven in practice. The ACTS, taking Douhetan logic a step further, developed the idea that by destroying a few key targets, the "industrial web" could be collapsed. This goal has also proven elusive with conventional weapons.

This belief in Douhetan/ACTS theory is a common thread in the air campaigns studied in this paper. In World War II, proving this theory drove U.S. airmen to argue against the Transportation Plan. During the formulation of the Strangle air campaign, the airpower strategists believed they could destroy the only “vital link” available -- the North Korean transportation system. In the Vietnam war, airpower strategists advocated an air campaign against the 94-targets considered to be a part of the “industrial machine,” even though by any objective standard, North Vietnam was a third-world nation with no significant industrial capacity. As recently as Desert Storm, airpower strategists regularly referred to the Douhetan/ACTS mechanism of the Iraqi people rising up against Saddam because of the hardships caused by the strategic attack.

Identifying, finding, attacking and destroying pieces of the enemy’s target array to achieve the designated political and military objectives is the primary mission of the Air Force. The challenge for airpower strategists has been how to accomplish that mission effectively. The Air Force cannot afford to waste resources on pursuing the destruction of targets that do not contribute to the desired outcome. It would be appropriate, as a result of the analysis in this paper, to propose some elegant solution to improve our ability to link destruction to outcome. Unfortunately, there is no elegant solution. One solution is to develop officers with the breadth and depth of understanding in the art of war and airpower theory necessary to see beyond simplistic cause-effect relationships. As General McPeak said, effective employment of airpower is about thinking, attitude, and imagination. The best that the Air Force can do is foster the development of the future airpower strategists as well as airpower strategies based on critical thinking, study, and analysis.

Thus, in closing, we can only say that the linkage between destruction of the “right” targets and the desired outcome is still missing. The Destruction-Outcome Linkage Model has been only a modest attempt to provide a framework for understanding one possible way of thinking about the linkage. There is much more work needed in this

area. It may be that there will never be a definitive answer to the linkage, but we must continue to search for the answer.

Notes

²⁹² General Merrill A. McPeak, "The Key to Modern Airpower," Air Force Magazine 76, no. 9, September 1993, 46.

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